



Development of App. for Efficient Safety and Health Management of Workplaces for Disabled Persons

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Abstract

Purpose: It is necessary to prepare more groundbreaking measures to prevent recurrence in order to reduce the number of industrial accidents in Korea that occur steadily. In particular, since workers with disabilities are much more vulnerable to disaster safety than non-disabled workers, there is a great need to build a customized safety environment system suitable for the characteristics of the work in which workers with disabilities work and to promote management efficiency. **Research design, data and methodology:** Based on the analysis of the actual status of safety and health management of workplaces for the disabled, such as small, medium-sized and major businesses in Korea, an app was designed and developed to improve safety and health management efficiency of workplaces for the disabled. First, it was designed so that managers of workplaces with disabilities can understand at a glance key legal information that managers need to know and it was improved to suit the eye level of disabled workers so that they could self-evaluate the risk of their work by applying the risk assessment model for workplaces with disabilities. In addition, a mobile education environment was created in which safety and health education contents suitable for the characteristics of disabled workers can be learned by themselves. **Results:** When this app is applied to domestic workplaces, it is possible to check the exact contents of occupational safety and health education and easily search and check various legal information anytime, anywhere, allowing managers and disabled workers to quickly and efficiently manage various safety information. **Conclusions:** In addition, the establishment of a mobile safety and health management system that can quickly identify and clearly respond to various legal standards and risks of workplaces with disabilities can be expected to help prevent industrial accidents at workplaces with disabilities in Korea.

Keywords : workers with disabilities , risk assessment, safety and health education, safety and health check, mobile safety and health management system

JEL Classification Code : I18, I30, I31, I38

1. Introduction

1.1. Research Background and Purpose

Due to Korea's rapid industrialization, there are more man-made disasters than natural disasters. Major accidents

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at domestic workplaces, such as the recent death of Kim Yong-gyun and a fire accident at a logistics warehouse in Icheon, are prime examples. In order to reduce the domestic industrial accidents that occur steadily, the importance of safety and health management is being emphasized, such as the revision of the Industrial Safety and Health Act and the establishment of the Serious Accident Punishment Act. In 2017, related ministries such as the Ministry of Public Administration and Security and the Ministry of Health and Welfare prepared 'comprehensive measures for the safety of the disabled' to promote the safety of the disabled. Therefore, the necessity of researching a system that can efficiently manage by establishing a smart safety environment system suitable for the work characteristics of disabled workers is increasing. This study is concerned with ensuring efficient safety at workplaces for the disabled. First, safety, education and training, disaster prevention, firefighting, etc. can be easily checked anytime and anywhere, and second, safety checks and risk assessments are performed with smartphones. Third, we propose an app model by establishing three research goals: establishing a mobile education environment system to spread a safety culture for the disabled.

1.2. Prior Research

1.2.1. Previous Research on Previous Papers

Table 1: Analysis of Previous Studies

A Study on the Measurement of Safety Culture Levels in Employment Places for the Disabled (Yang, 2021)	Identify the level of safety culture at workplaces employing the disabled and use it as basic data to operate a safe workplace
Evaluation of the effectiveness of safety education contents for the disabled (Kim & Jeong, 2020)	Development of various safety contents through the analysis results of the safety experience center of the disabled
A study on how to activate safety education for the disabled (Nam, 2020)	After personally experiencing the safety experience center of the disabled, we analyze it and provide it as various safety contents.
A study on the development of a safe evacuation manual for disabled workers (Bae et al., 2015)	Provide evacuation manuals and methods to disabled people working at workplaces in case of disaster
Implementation of a health management web application customized for the disabled for health managers (Ho et al., 2019)	To provide consistent and effective health care services to health managers for people with disabilities who need constant care

Existing studies contain a wide range of safety-related contents, such as improving safety culture in workplaces employing disabled people, providing safety education contents for disabled people, and providing evacuation manuals in case of disaster. In particular, in the app implementation thesis for health managers, only health services tailored to the disabled are provided to managers. It is differentiated from existing papers in designing and developing contents to participate in health management and education and training.

1.2.2. Prior Research on the Development of Existing Safety and Health Apps

Before designing the app, A preliminary survey is conducted on previously developed safety and health mobile apps to compare the main functions of each app, and to set the strengths and development direction. Through this, the direction of customized design for disabled workers is determined, and the distinctive points of the safety and health app for workplaces with disabilities that this study intends to design are set.

(A) Scope of Research

Using safety and health as keywords, apps provided on Android were searched for and content review was attempted. Only apps that can be downloaded for free in Korea were targeted, and the scope was limited to apps related to disaster safety developed by national institutions. A total of 4 apps, including 'Facility Self-Safety Inspection' developed by the Homeland Safety Management Agency, 'Safety Report' and 'Safety Stepping Stone' developed by the Ministry of Public Administration and Security, and 'Crisis Escape Safety and Health' developed by the Korea Occupational Safety and Health Agency A research study was conducted.

(B) Analysis of Strengths and Weaknesses and Improvement Plan

The strengths and improvement plans of 4 domestic apps were derived and shown in <Table 2>.

Table 2: Strengths and Improvements of Existing Safety and Health Apps

Application Name	Advantages	Improvement
Facility autonomous safety inspection	-Able to understand at a glance various related laws and regulations related to facility safety	-It is necessary to specify the items of safety education video materials

Safety report	-Excellent post-processing and feedback according to report of risk factors	- Lack of videos related to safety education materials and people with disabilities
Safety stepping stone	-Inherent text font size change function allows content to be enlarged and viewed	- There is a need to provide additional information tailored to the disabled in relation to educational materials such as national behavior tips
Crisis escape safety and health	-Self-diagnosis of work risks is possible through the safety inspection checklist -Provision of easy safety education materials using webtoons	-Many materials focused on construction safety -Non-existence of safety inspection checklist suitable for the work characteristics of the disabled

2. Body

2.1. Review of Statutory Standards

It is designed so that managers can quickly grasp the legal provisions related to workers with disabilities through the app, thereby increasing the manager's work efficiency and strengthening efforts to prevent industrial accidents.

Prior to the study, among the ordinances of local governments and Seoul Metropolitan City, ordinances related to the safety and health of the disabled were investigated to identify differences in detailed items between regions. Through this, I would like to find out the strengths and weaknesses of each local ordinance related to the disabled and suggest improvement measures.

(A) Comparison of Local Government Ordinances

The target regions of the local governments selected in this study were limited to 4 regions including Seongnam-si, Suwon-si, Yongin-si, and Goyang-si, which are cities with a population of 1 million among the cities belonging to Gyeonggi-do. The ordinances are summarized in <Table 3>, divided into ordinances related to the safety and health of workers working in workplaces with disabilities.

Table 3: Comparison of Ordinances of Local Governments with a Population of 1 Million or more in Gyeonggi-do

	Seongnam City	Suwon City	Yongin City	Goyang City
Safety	-Disaster and Safety Management Ordinance	-	-	- Basic ordinance for disaster and safety management
Health	- Ordinance on indoor air quality management - Ordinance on fine dust reduction and management	- Ordinance on indoor air quality management - Ordinance on fine dust reduction and management	-	- Ordinance on indoor air quality management

(B) Detailed Comparative Analysis of Local Government Ordinances

Based on <Table 3>, a detailed comparative analysis was conducted on the ordinances corresponding to each item. As a result, it was found that even if the ordinances follow the same upper law, there are provisions that differ by local government. The current status is as follows, and only the parts that differ by article are separately extracted and shown in <Table 4>.

Table 4: Local governments - Disaster and Safety Management Ordinances and Provisions

Seong-Nam	Home town
Article 3 (City Responsibilities) ② The Mayor shall secure the organization and manpower and necessary budget to smoothly carry out the duties of Paragraph 1.	-Article 3 (Responsibilities of the Mayor) ② <u>When preparing policies pursuant to Paragraph 1, the Mayor shall consider the characteristics of the disabled, the elderly, pregnant women, infants and children, etc. and those accompanying them.</u>
Suwon	Yongin
-	-

According to <Table 4>, 「Disaster and Safety Management Ordinance」 in the case of Seongnam City, it is judged that there are insufficient provisions for disaster

vulnerable classes. Therefore, it is necessary to closely review or supplement related matters.

Table 5: Local Governments - Ordinances and Provisions on Indoor Air Quality Management

Seongnam City	Suwon City	Yongin City	Goyang City
-Article 12 (Support for Facilities Used by the Health Vulnerable Class) ③ The Mayor may provide support such as education and publicity so that the vulnerable class under Paragraph 1 can respond appropriately to pollutants .	-Article 10 (Support for Facilities Used by the Health Vulnerable Class)	-	-Article 10 (Support for Facilities Used by the Health Vulnerable Class)

According to <Table 5>, the 「 Ordinance on Indoor Air Quality Management」, in the case of Seongnam City, separately specified support for education and promotion of the vulnerable class through three items. All other contents were the same in all four poems. Therefore, it is judged that there is a need for other local governments to modify and supplement by separately regulating matters related to education and publicity.

(C) Comparison of Seoul Metropolitan Government Ordinances

In this study, a total of 4 areas (Songpa-gu, Gangnam-gu, Nowon-gu, and Eunpyeong-gu), 2 in Gangbuk and 2 in Gangnam, were selected among districts in Seoul with a population of 450,000 or more. The ordinances were selected as ordinances related to the safety and health of workers working in workplaces with disabilities and are shown in <Table 6>.

Table 6: Comparison of Ordinances in Songpa-gu, Gangnam-gu, Nowon-gu, and Eunpyeong-gu

	Songpa-gu	Gangnam-gu	Nowon-gu	Eunpyeong-gu
Safety	- Basic Ordinance on Disaster and Safety Management	- Basic Ordinance on Disaster and Safety Management	- Basic Ordinance on Disaster and Safety Management	- Basic Ordinance on Disaster and Safety Management
Health	-	-	-	- Ordinance on indoor air quality management

(D) Comparative Analysis of Seoul Ordinances

Based on <Table 6>, the ordinances corresponding to each item were compared and analyzed in detail. As a result, even if the ordinances follow the same upper law, it was found that there are differences in each distinction. The situation is as follows.

Table 7: Seoul - Disaster and Safety Management Ordinances and Provisions

Songpa-gu	Gangnam-gu
Article 43 (Education and training related to on-site action manuals) Article 50 (Financial Support) ① The head of a district may establish and support policies for those vulnerable to disasters and safety, such as the low-income class, the elderly, and the disabled .	Article 35 (Safety Education) Article 38 (Support for Disaster Vulnerable Classes) ① The head of a district establishes policies for those vulnerable to disasters and safety, such as the low-income class, the elderly, and the disabled .
Nowon-gu	Eunpyeong-gu
Article 62 (Safety Education) Article 64 (Support for Disaster Vulnerable Classes) ① The head of a district establishes a policy for those vulnerable to disasters and safety, such as the low-income class, pregnant women, the elderly, and the disabled .	Article 46 (Financial Support) 1) Rewards, etc. may be paid within budgetary limits to those who report disaster risk factors pursuant to Article 36 (1).

According to <Table 7>, Eunpyeong-gu, unlike other regions, does not specify the contents of education and financial support for the vulnerable, so it is judged that it is necessary to stipulate them separately.

Table 8: Seoul City - Ordinances and provisions on indoor air quality management

Songpa-gu	Gangnam-gu	Nowon-gu
-	-	-
Eunpyeong-gu		
Article 9 (Support for Facilities Used by the Health Vulnerable Class) ① The head of a district provides support to the owner, etc. of the facility so that the indoor air quality of the facility mainly used by the health vulnerable class and youth can be properly maintained, managed, and improved.		

According to <Table 8>, unlike other regions, Eunpyeong-gu has an ordinance on indoor air quality management, and in particular, it stipulates the health management of the disabled by specifying support for facilities used by the health-vulnerable class.

2.2. Safety Inspection

2.2.1. Concept and Classification of Safety Inspection

Safety inspection refers to actions or means to secure the safety of the workplace by identifying unsafe behavior of people and unsafe conditions of machinery, equipment, and facilities. (Park, 1993) In the above paper, the safety inspections that managers of workplaces where disabled workers work are classified into health and safety, and the laws and regulations suitable for each field are presented in a table so that you can easily check the basis. In addition, to

improve the efficiency of safety inspection by managers, the contents corresponding to <Table 9> I tried to find and arrange them in the form of a table, and to install and provide them in this app for the disabled.

Since disabled workers are relatively vulnerable in the event of an accident, the safety field was presented by dividing them into occupational safety, facilities, firefighting, and elevator fields, focusing on that part. Laws and legal grounds for measuring indoor air quality were to be presented. In this way, by newly designing and presenting the 'HS (Health, Safety) Integrated Safety Checklist', which includes both safety and health fields, the efficiency of the manager's safety and health management work was promoted.

2.2.2. Safety Checklist

Table 9: HS Safety Checklist (Legal Basis)

Safety			
	Statute	Inspection type	Article
Industry Safety Health	Occupational Safety and Health Act	Tour inspection (employer, business owner + contractor, safety and health manager, management supervisor)	① Supervisor: Article 15 of the Enforcement Decree ② Safety manager: Article 18 of the Enforcement Decree ③ Health manager: Article 22 of the Enforcement Decree ④ Employer: Article 64 of the Act, Article 80 of the Enforcement Rules ⑤ Employer + contractor: Article 82 of the Enforcement Rule
Facility	Special Act on Safety and Maintenance of Facilities	Regular/Precise/Emergency Safety Inspection, Precise Safety Diagnosis	① Regular and detailed safety inspection: Article 11 of the Act, Article 8 of the Enforcement Decree ② Precise Safety Diagnosis: Article 12 of the Act, Article 10 of the Enforcement Decree ①, ② Common: Article 17~18 of the Act, Article 13~14-2 of the Enforcement Decree, Article 13~15 of the Enforcement Rule ③ Emergency Safety Inspection: Article 13 of the Act, Article 11 of the Enforcement Decree, and Article 11 of the Enforcement Rule
Fire fighting	Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management	Operational function check, comprehensive precision target	① Operational function inspection, comprehensive overhaul: Article 25 of the Act, Articles 17-19 of the Enforcement Rules
Lift	Elevator Safety Management Act	Self-inspection, eyesight inspection (regular inspection, occasional inspection, precise safety inspection)	① Self-inspection: Article 31 of the Act, Articles 28-30 of the Enforcement Decree ② Eye spot inspection: Articles 32~33 of the Act, Articles 53~57 of the Enforcement Rules, and Articles 8~13 of 「Elevator Installation Inspection and Safety Inspection Operation Regulations」

Health/Environment			
Work Environment and Health Checkup	Occupational Safety and Health Act	Working Environment Measurement	Articles 125-128 of the Act, Articles 95-96 of the Enforcement Decree, and Articles 186-194 of the Enforcement Rules
		Health Examination and Health Management	Articles 129-141 of the Act, Articles 97-100 of the Enforcement Decree, and Articles 195-224 of the Enforcement Rules
Indoor Air Quality	Indoor Air Quality Management Act	Indoor Air Quality Measurement	Act Article 3~4, Article 4-7 Article 5~7, Article 12, Enforcement Decree Article 2, Article 4-3, Article 5, Article 10, Enforcement Rule Article 2-2, Article 12 Articles 3-5, 11 and 12

2.3. Safety and Health Education

2.3.1. Review of Statutory Compulsory Education

Statutory compulsory education refers to education that employers must provide to workers. This law was created to prevent safety accidents that may occur in the workplace and to guarantee the safety and human rights of workers. In workplaces with 5 or more full-time workers, this law must be implemented once a year.

This study analyzed the contents of the statutory compulsory education that managers and workers of workplaces with disabilities must receive, focusing on three items: safety, health, and environment, and integrated and organized the key items to make a new proposal.

(A) Safety and Health Education Under the Occupational Safety and Health Act

According to Article 29 of the 「Industrial Safety and Health Act」, employers must provide regular safety and health education to their workers. The provisions corresponding to safety and health education under the 「Industrial Safety and Health Act 」 and the education hours and contents of worker safety and health education according to Article 26 of the 「Industrial Safety and Health Act Enforcement Rule 」 are extracted only for managers of workplaces with disabilities and workers with disabilities, respectively. It is shown in <Table 10> and <Table 11>.

Table 10: Statutory compulsory education under the Occupational Safety and Health Act

Statutory Compulsory Education	Legal Basis
-Worker safety and health education	Industrial Safety and Health Act Articles 29~30, 32~33 Articles 26 to 27 of the Enforcement Rules of the same Act

-Education for safety and health management managers, etc.	Article 15, 16, 17, 18, 19, 32 of the Occupational Safety and Health Act Articles 29, 30 and 36 of the Enforcement Rule of the same Act
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Table 11: Occupational Safety and Health Education Training Hours by Curriculum

Curriculum	Education Target	Training Time
go. Regular Education	Office workers	3 hours or more every quarter
	Workers other than office workers	Workers directly engaged in sales 3 hours or more every quarter
		Workers other than those directly engaged in sales 6 hours or more every quarter
	Person in supervisory position	16+ hours per year
me. Training when Hiring	Daily worker	more than 1 hour
	Workers excluding daily workers	more than 8 hours
All. Training when Work Contents Change	Daily worker	more than 1 hour
	Workers excluding daily workers	more than 2 hours

<Table 12> shows the contents of training for safety and health management managers in relation to Article 29, Paragraph 2 of the Enforcement Rules of the Industrial Safety and Health Act.

Table 12: Education for Safety and Health Managers, etc.

Education Target	Training Time	
	New Education	Continuing Education
go. Safety and health manager	more than 6 hours	more than 6 hours
me. Safety managers, employees of specialized safety management institutions	34+ hours	more than 24 hours
All. Health managers, employees of specialized health management institutions	34+ hours	more than 24 hours
bar. Safety and health manager	-	more than 8 hours

(B) Safety and Health Education in Accordance with Firefighting Related Laws

Statutory compulsory education related to firefighting is aimed at persons concerned, workers, and residents of specific firefighting objects. 「Regulations on Fire Safety Management Regarding Fire Safety Management of Public Institutions」 and Compulsory education matters for the 「Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management」 are summarized and shown in <Table 13>.

Table 13: Statutory Compulsory Education under the Fire Protection Act

Legal Completion Education	Legal Basis
Training of fire safety managers	-Regulations on Fire Safety Management of Public Institutions Article 8
Fire training and education	-Regulations on Fire Safety Management of Public Institutions Article 14
Fire drill	-Article 22 of the Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management
	-Article 23 of the Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management

Firefighting education	-Article 14-3 of the Enforcement Rule of the Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management
Lecture education	-Articles 29 and 32 of the Enforcement Rules of the Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management
Practical training	-Article 41 of the Act on Fire Prevention, Installation and Maintenance of Fire Protection Facilities, and Safety Management -Articles 36 and 37 of the Enforcement Rules of the Act

2.4. Risk Assessment

(A) Background

Risk assessment is in accordance with Article 36 of the 「Industrial Safety and Health Act」 It is a safety management system in which employers engage workers to find harmful and risk factors themselves, evaluate them, and establish and implement improvement measures. It refers to a series of processes of estimating, deciding, establishing and implementing reduction measures. However, the focus is still on the safety of general workplaces, and customized risk assessments for disabled workers are not universal. Although there was a history of risk assessment conducted by the Korea Employment Agency for the Disabled for trainees with disabilities, it was judged that there was a limit for disabled workers to judge for themselves in the composition of the evaluation items, and it was judged that full improvement was necessary because it did not reflect the post-COVID-19 era.

Therefore, in this study, the evaluation items of the risk assessment were subdivided by the types of accidents that frequently occur in workplaces with disabilities, and the design was designed with a focus on the prevention of COVID-19. In addition, it was intended to encourage active participation by users by enabling the use of risk assessment through the app, and to help disabled workers easily evaluate risks by introducing a new color conversion and star rating system.

(B) Comparison of Risk Assessment for General Workplaces and Workplaces for the Disabled

Table 14: Risk assessment for general workplaces and workplaces with disabilities

Division	Contents of Evaluation	Disaster Risk Level
Risk assessment for general workplaces	-Because various risk machines are used, more professional and detailed contents are written.	-There is a lot of work using equipment, so exposure to risk factors is highly likely to lead to serious accidents

Risk assessment for workplaces with disabilities	-Since most of the work is simple labor, it is composed of general, relatively simple and common contents -It can be used universally throughout the workplace	- Even though they are engaged in relatively simple work, even if the degree of accident is low, even a small part of risk factors can act as a disaster for people with disabilities.
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(C) Thesis Characteristics of Risk Assessment for Disabled Entrepreneurs

Table 15: Comparison of Risk Assessment Contents of Employment Agency for the Disabled and Risk Assessment of This Study

		Employment Agency for the Disabled Risk Assessment	Risk Assessment of this paper
Evaluation Items	Classification	-Common, precious metal crafts, machinery/electricity/electronics, others (nail art), new industry convergence (drone), food service industry	-Common (focused on <u>types of disasters that frequently occur in workplaces with disabilities and prevention</u> of COVID-19)
	Contents	- It is possible to identify disasters that can lead through risk factors, and understand the connection between risk factors and accidents	
Risk Estimation	Possibility	-4-point scale method (based on the possibility of damage and the history of safety accidents)	<u>specify</u> the possibility of damage and the history of safety accidents by period)
	Singularity	-	By setting a period, risk assessment estimators can estimate frequency more objectively.
	Importance	-5-point scale method (focused on the possibility of performing the task)	
Risk Determination	Scoring	Probability of Occurrence * Significance of Occurrence	
	Range	-16 to 20: very high -15: high -9~12: slightly higher -8: normal -4~6: low -1 to 3: very low	-15~20: Immediate improvement after stopping work -8~12: Rapid improvement -4~6: planned improvement -1~3: Improve as needed
	Singularity	-unacceptable: medium to very high -Acceptable: very low to low	-Red zone (15-20), orange zone (8-12), yellow zone (4-6), blue zone (1-3) divided into 4 colors (refer to national disaster alert level color)
Utilization Through the App		-	- Risk assessment possible through the app -Introduction of a star point system based on the final calculated score (refer to the safety management evaluation grade of the workplace of the Korea Occupational Safety and Health Agency)

(D) Workplace Safety Score Calculation Method and Star Rating System

Table 16: Calculation of Safety Scores for Workplaces with Persons with Disabilities

Overall Score	Number of Stars	Situation
30-60	★	Defect (immediate improvement)
60-80	★★	Improving
80-100	★★★	Usually
100-120	★★★★	Great

Assuming that there are 30 items in the risk assessment checklist, the calculation method applies 1 point for the red zone, 2 points for the orange zone, 3 points for the yellow zone, and 4 points for the blue zone. number was assigned. Through the above star rating system, a proposal was made to finally identify at a glance whether each workplace is an excellent workplace or a poor workplace in terms of work.

3. Application Design

3.1. Application Configuration

It is an integrated application that can be used by both disabled workers and managers who manage them. The composition is as follows and the design of the main screen is shown in <Figure 1>.

- (1) Law
- (2) Safety inspection
- (3) Safety education
- (4) Risk assessment



Figure 1: Application Configuration

3.2. Design of Statutory Information Contents

It is designed so that when you click on the provision of law information category, you can check major ministries, major laws and relevant provisions at a glance. Domestic central government agencies were organized around the Ministry of Employment and Labor, the Ministry of Health and Welfare, and the Ministry of Public Administration and Security, which are highly related to workplaces for the disabled. The law information link model is shown in <Figure 2>.



Figure 2: Legal Information Application Design

3.3. Design of Statutory Information Contents

The safety and health education contents of the app to be designed in this study were composed of two categories. First, safety and health education materials related to the disabled, who are vulnerable to disasters, were collected and provided in the form of a table with pictures so that they could be visually confirmed. The design of the application is shown in <Figure 3>.



Figure 3: Safety and Health Education Contents

Second, safety and health education materials classified by types of accidents that occur in workplaces with the disabled are provided. The category of accident type was composed in the order of falling, falling, getting caught, cutting, stabbing, cutting, and bumping with reference to “Sexual Harassment Prevention and Safety and Health Education in the Workplace” (Korea Institute for the Disabled, 2019). In addition, contents related to excessive motion, fire prevention and fire extinguishing and evacuation methods, electric shock, emergency rescue and medical treatment, and COVID-19 were added to be loaded with related contents. The same disaster was excluded.

Links to relevant educational materials were selected and loaded with emphasis on materials suitable for the eye level of workers with disabilities, such as safety training videos customized for disabled people by the Korea Institute for Persons with Disabilities and the Ministry of Public Administration and Security. The design of the application is shown in <Figure 4>.

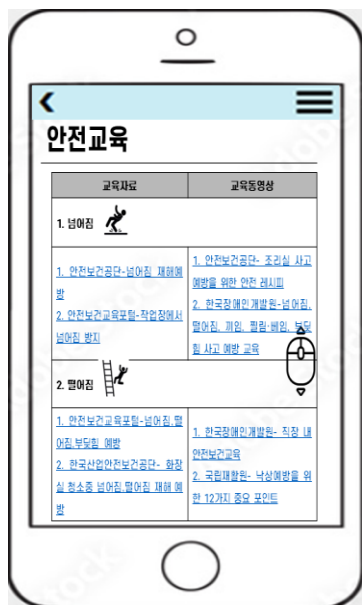


Figure 4: Example of Safety and Health Education Content Video Model

3.4. Design of Safety Inspection Contents

If you click on the safety inspection category, the safety inspection items that managers who manage disabled workers must do are classified into safety and health, so that you can check them at a glance. In addition, a 'self-diagnosis safety checklist' that disabled workers conduct on their own is also provided so that risk factors in the workplace can be identified in advance and improved immediately.

The safety checklist above is based on 'Research on Safety Evacuation Manual for Disabled Workers (Korea Employment Agency for the Disabled, Employment Development Institute, 2015)', 'Research on Safety and Evacuation Manual for Residential Facilities for Disabled Persons (Ministry of Health and Welfare, 2014)', and 'Infectious Disease Response Manual for Disabled Persons (Ministry of Health and Welfare, 2020)', etc., to organize inspection items so that workers with disabilities can easily understand them, and also presented legal grounds for each item to secure the reliability of the data. The design of the application is shown in <Figure 5>.

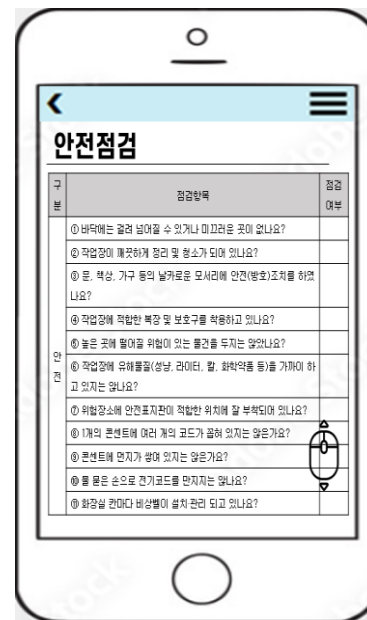


Figure 5: 'Self-Diagnosis Safety Checklist' Application Design

3.5. Design of Risk Assessment Contents

When clicking on the risk assessment category, as in the safety and health education contents, the risk assessment items are listed in order according to the order of occurrence of accidents according to the statistical data announced by the Korea Institute for the Disabled. Accidents were classified from fall accidents to collision accidents, which caused the most accidents, and through risk assessment, managers and disabled workers identified potential risks in the workplace and removed them to reduce industrial accidents. <Figure 6> shows the risk assessment design of the app, which is colored in color so that even disabled workers can easily identify the risks corresponding to the inspection contents.



Figure 6: Risk Assessment Application Design

4. Conclusion and Expected Effect

The purpose of this study is to design and develop an efficient app suitable for the characteristics of managers and disabled workers in workplaces with disabilities, so that managers can promote efficiency in safety and health management, and workers with disabilities can easily identify and respond to work hazards by creating a smart education environment. Its purpose is to contribute to the establishment of a safety culture for disabled workers.

In order to design a more efficient app related to this study, previous studies on safety and health of the disabled and existing apps were referred to, and the strengths and weaknesses of previously developed safety and health apps were compared and analyzed. Through this, a new safety and health application suitable for workers and managers of workplaces with disabilities was designed and proposed.

The expected effects that can be obtained by using this app for managers and disabled workers of workplaces with disabilities are as follows.

(1) Key legal information to be confirmed by managers of workplaces for the disabled is integrated and presented so that they can be quickly identified and understood. This made it possible for managers to make quick and reasonable decisions regarding overall safety and health management.

(2) Risk assessment items for the disabled were added to the contents of the app, and color marking was added as a criterion suitable for the characteristics of disabled workers

for easy identification. In addition, it is necessary to classify and present the risks of the task in charge through colors. It is different from the existing risk assessment system in that it has been implemented, and visibility has been increased to make it easier for workers with disabilities to grasp.

(3) An integrated safety inspection checklist suitable for workplaces where disabled people work was newly developed so that managers or disabled workers can check or check the risks of work on their own. If this app is used efficiently, it is expected to contribute to the formation of a safety culture and strengthen safety awareness in relation to the work of disabled workers.

(4) The efficiency and convenience of safety and health education was improved through the use of smartphones by loading safety and health education contents suitable for the level of disabled workers as links or videos.

This study designed and developed safety and health education for disabled workplaces and safety check and risk assessment models for disabled people, which have not yet been developed in Korea, as a smartphone app. It has meaning. If this app is applied to workplaces with disabilities in Korea, safety accident prevention and safety and health management within the workplace. It is expected that a high effect can be obtained in terms of efficiency improvement.

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