Content Management System to Support Improvement in Quality of Fitness Testing of Athletes

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Abstract: Fitness testing is conducted to evaluate athletes' physical fitness and provide scientific evidence and data that will help improve their performances. The validity and reliability of the data need to be guaranteed, and this depends on the proficiency of staff in charge of testing. However, there are several problems in staff training. In this study, we propose a content management system to support staff training improvement for quality assurance of athletes' fitness testing.

Keywords: Quality assurance, fitness testing, elite sports, skill proficiency, CMS, blended learning

1. Introduction

The Japan Institute of Sports Sciences (JISS) conducts surveys and measurements for several factors of physical fitness that help determine sports performance. Furthermore, JISS (2014) provides knowledge and data to help athletes improve their performances by indicating their fitness strengths and weaknesses. Thus, test results are used to set appropriate individual training intensity. Moreover, test results can help implement athletes' training programs efficiently and effectively. Whether a current training program is working well can also be confirmed from these test results, and the athlete's progress can be monitored. Additionally, data on elite athletes and averaged data on many athletes can become criteria for talent identification and transition. Therefore, the validity and reliability of the testing should be guaranteed.

The Australian Institute of Sport (AIS, 2014) conducts a quality assurance program for fitness testing, called the National Sport Science Quality Assurance Program. Since JISS was established in 2001, it has also standardized fitness testing by creating a unified manual. However, in implementing its staff development program, JISS is faced with various problems and constraints.

In this study, we present an overview and the problems of the JISS staff development program. Furthermore, we propose a content management system (CMS) to support the staff training program and solve its problems.

2. Staff Training for Proficiency at JISS

2.1 Overview of staff training for proficiency at JISS

At JISS, staff proficiency training comprises workshops and seminars on fitness testing, self-learning and self-practice, and proficiency checking (Figure 1).

2.2 Workshops and seminars on fitness testing

At JISS, workshops and seminars on fitness testing are held for new staff, called “rookie staff,” during the second week of April. In these workshops, the rookie staff attend lectures on basic knowledge and cultivate an appropriate attitude for fitness testing of athletes. For acquisition of skills related to fitness testing, first, the rookie staff observe demonstrations and then practice fitness testing using the actual measurement equipment.

2.3 Self-directed learning and self-practice

After these workshops and seminars, the rookie staff manage their own training through self-learning and self-practice. For self-learning, they study the manual created by expert JISS staff. Based on testing procedures in the manual, they practice fitness testing on each other to develop proficiency. For each fitness test, they use a checklist to confirm their proficiency (Table 1).

2.4 Skill proficiency check-up

After the rookie staff complete self-learning and self-practice, a “skill proficiency check-up” is administered to confirm their skill and knowledge. This check-up is conducted under the same conditions as actual testing of athletes. Its flow contains preparation of the test, the actual testing of the athlete, feedback to the athlete, and finally, storing the equipment and materials. Throughout this flow, several evaluators judge the individual rookies’ skill levels using a check-sheet especially designed for the evaluation and also associated with the self-learning and self-training checklist. During and after the check-up, individuals are questioned about their knowledge. Evaluators perform comprehensive evaluation of whether each rookie’s knowledge and skill achieves the evaluation criteria.

The rookie staff receive their individual evaluation results, and those who are successful are then qualified to perform fitness testing of athletes. On the basis of feedback, unsuccessful staff study and practice to improve their skills and then re-take the check-up.

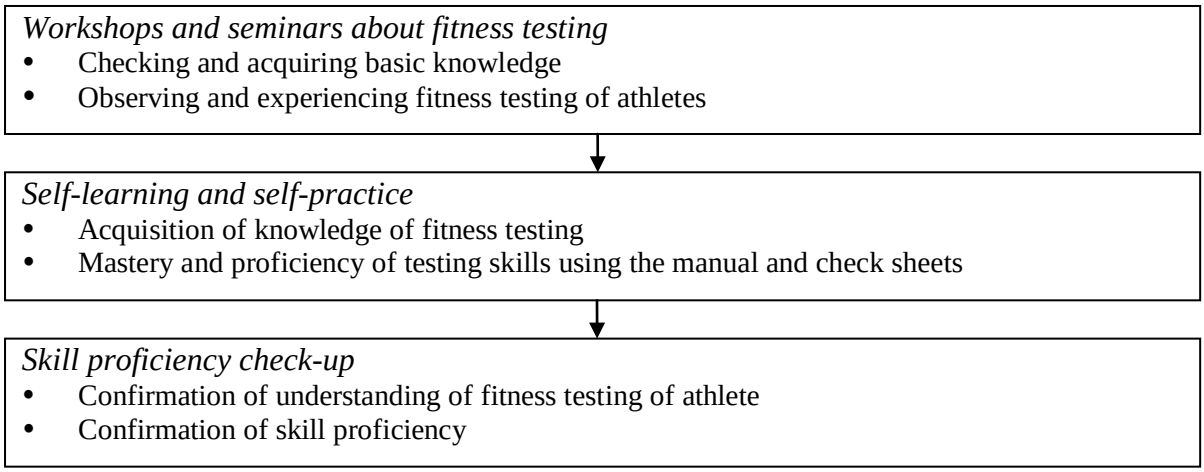

Figure 1. Flow of measurement training.

Figure 2. Biodex System 4.

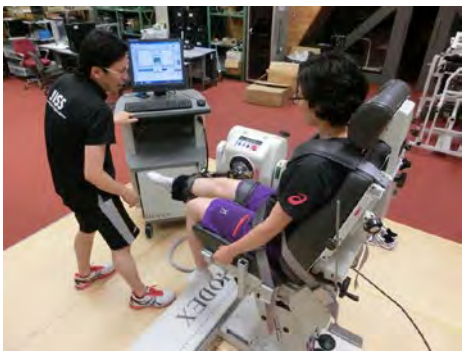

Figure 3. Scene of Measurement.

Table 1: Example of checklist (example of equipment: Biodex System 4).

Procedure	Evaluation point
PC start-up	Following the manual's instructions
Database connection	Selecting the correct database
Subject registration and selection	Following the manual's instructions Registering using the correct method
Protocol selection	Selecting the correct protocol
Explanation prior to measurement	Explaining clearly and correctly
Seating subject on Biodex System 4	Confirming the subject's physical condition (e.g., confirming the subject's injury) Following the manual's instructions
Setting center of rotation	Confirming and setting correct center of rotation
Setting range of motion	Following the manual's instructions (e.g., determining the position of maximal extension)
Warm-up instructions	Implementing warm-up adequately and sufficiently
Explanation of measurement flow	Explaining clearly and correctly
Consideration of subject	Conversing with subject appropriately
Confirmation of measurement completion	Checking continues, and completing data collection Creating a measurement report in accordance with the manual's procedure
Explanation of measurement result	Explaining results based on correct knowledge.
Total time for the procedure	Completing testing within 30 min from measurement preparation to explanation of result (Measurement time, approximately 20 min)

3. Problems in Improving Testing Skill

This section provides a description, along with some specific examples, of the problems in self-learning and self-practice. First, Figure 1 displays the conceptual flow of self-learning and self-practice in some detail. For "Acquisition of knowledge of fitness testing," if practice has been inadequate, rookie staff are likely to remember only the fragmentary procedure shown in Table 1. In other words, although the rookie staff memorize each procedure, they do not understand the subtleties of the "evaluation point" and the linkages between procedures.

Furthermore, because the manual and checklist are intended to summarize the procedure, not for all athletes but only for the "standard" athlete, rookie staff must learn to adjust when testing individual athletes. Therefore, when the correct value is not obtained from the actual measurement, the staff must review and readjust the measurement procedure, and then re-measure. Of course, only one correct measurement is desirable. However, it is crucial that staff recognize an inaccurate or inadequate measurement, diagnose what is wrong with the procedure, make adjustments, and conduct re-measurement.

For example, during the measurement of thigh muscles' isokinetic strength with a dynamometer (Biodex System 4, New York, USA) (Figures 2 and 3), the graph of measured force is displayed as Figure 4. The peak value is adopted as an individual record. However, this device displays the waveform of measured force and records its peak value as correct data even if correct measurement is not conducted. In Figure 5, the athlete could not perform as strongly as compared with the athlete in Figure 4. In other words, the staff's explanation and the athlete's practice and/or warm-up are insufficient. Additionally, compared with the athlete's leg shown in Figure 6, that shown in Figure 7 is not fixed firmly. This may result in impulses or noise being measured in the waveform of force even if the measurement process itself is correct, as in Figure 8. Therefore, it is important for the staff to recognize these waveforms and incorrect points.

For acquisition of the ability to diagnose ‘what is wrong’, the rookie staff should practice on the actual equipment. Nevertheless the time and equipment for practice are limited in the current training program. In fact, even the practice equipment is occasionally used for actual fitness testing, further limiting practice opportunities.

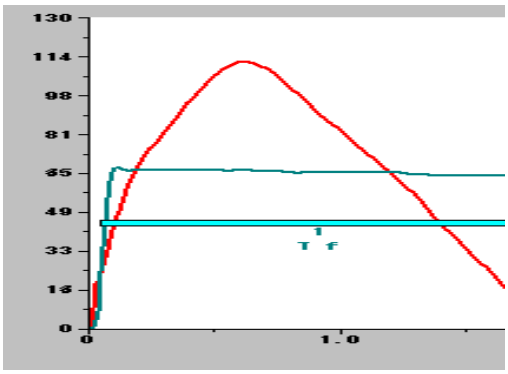

Figure 4. Example of correct waveform of force

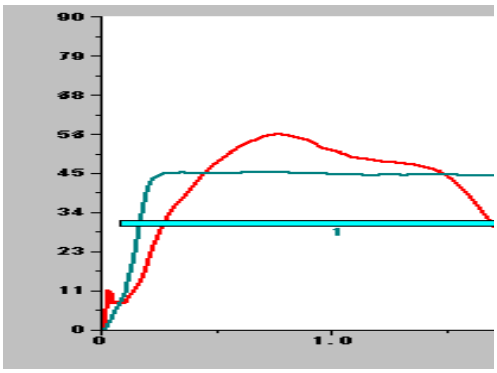

Figure 5. Example of wrong waveform of force

Figure 6. Leg fixed firmly

Figure 7. Leg not fixed firmly

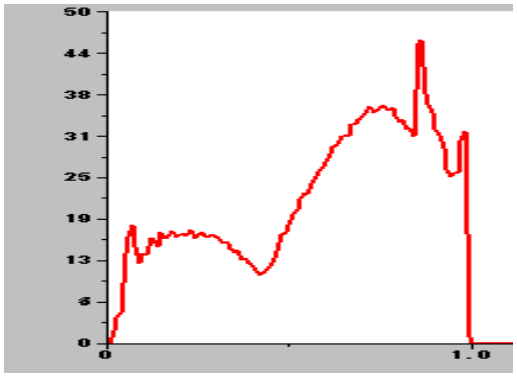

Figure 8. Example of wrong waveform including noise or impulse

4. CMS to Support Improvement of Testing Skill

4.1 Proposal of blended learning program and CMS to support the program

As explained, the current rookie staff training program depends on self-learning and self-practice. However, limited time and equipment availability cause some program inefficiency.

Thus, we suggest a blended learning program and CMS for self-learning, as depicted in Figure 9. CMS services can compensate for the lack of face-to-face instruction in the program. Because JISS is the domestic representative of athletes' fitness testing, this model can be expected to create a ripple effect on various relevant organizations.

4.2 Online Video Textbook: Delivery of practical instructional video materials

Because the checklist was created from the evaluators' standpoint, rookie staff have often faced difficulty in understanding its content. Furthermore, opportunities to observe demonstrations by skilled staff are limited.

Therefore, we propose to create video teaching materials that contain explanations and demonstrations by skilled staff, and to deliver it in the CMS. These materials will help rookie staff efficiently understand the subtleties of the "evaluation point" and the linkages between the fragmentary procedures. Moreover, even without equipment, opportunities for improved self-learning are provided. During their limited free time, rookie staff can learn fitness testing.

4.3 Online Test Sheet: Introduction of practice and test materials for preparation and review

As mentioned, practice time with the testing equipment is limited. Delivery of practice and test materials for preparation and review in CMS will support the currently limited learning opportunities with actual equipment and face-to-face instruction by skilled staff. The new preparation materials will help rookie staff learn the basic knowledge required for fitness testing in advance. Additionally, preparation materials will enable rookie staff to review the required skill proficiencies objectively.

4.4 Applied Q & A: Problematic case collection system

In actual fitness testing, responding flexibly to various athletes is essential. Therefore, accumulating experience of incidental failures and problematic cases is very important. Problematic cases, insolvable through use of the manual alone, should be collected for consideration of solutions and for practice problems.

Accordingly, we propose the introduction of a support system based on problem-based learning (PBL) in CMS. PBL with CMS for practical staff training in several domains, for instance, in nursing, (Majima, So, & Seta, 2006) has been proposed; however, in our domain, it has not been proposed. If skilled staff participate assertively in the collection activity, this system will help educate rookie staff and support skilled staff in charge of actual fitness testing.

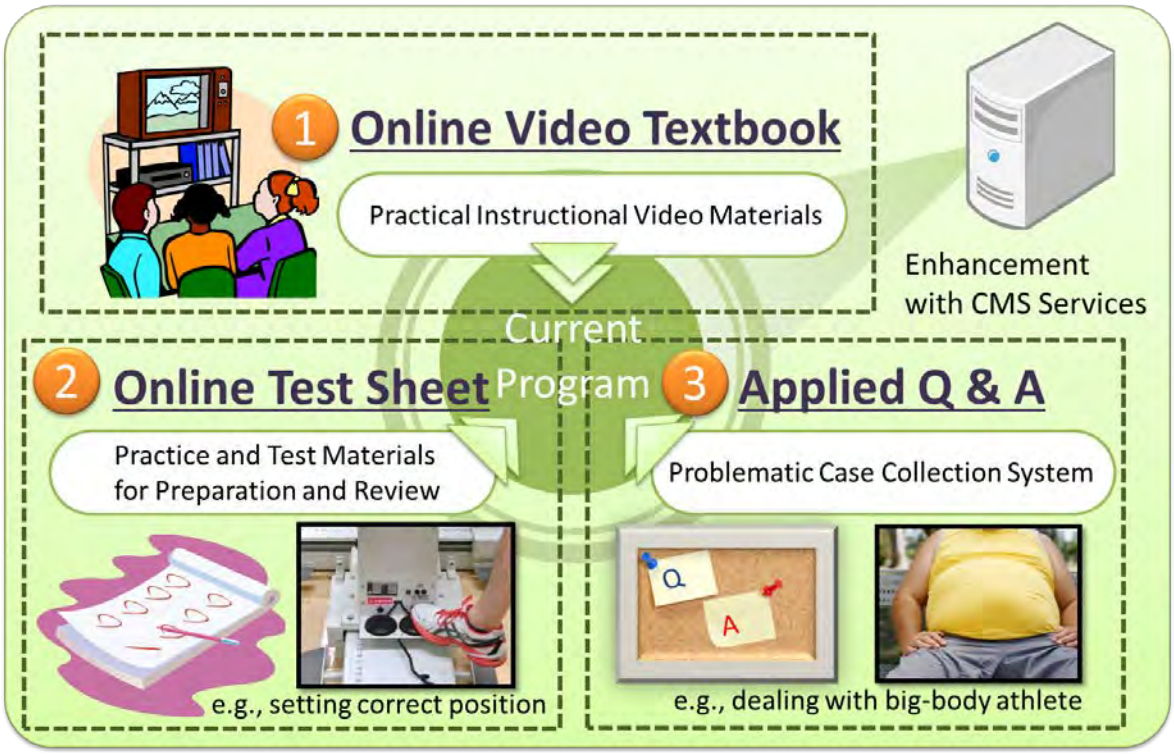

Figure 9. Proposal of blended learning program with CMS Services

4.5 Flow of Support Scenario with CMS

Supportive CMS services for effectively and efficiently promoting skill proficiency are not independent, but mutual. In fact, Figure 10 illustrates an example of support by the services shown in Figure 9. In correcting the test in Figure 8 of section 3, in many cases, rookie staff cannot understand that the problem involves fixing the leg firmly from the beginning, in addition to the evaluation points and procedures. Therefore, before recognizing the problem, but after watching the video of the first step as an initial learning strategy, rookie staff can confirm the key point at the second step.

After that, the next learning step shifts to PBL. Input by expert staff triggers reflective learning activities, such as re-watching and re-testing. Repeated self-learning can help rookie staff deeply understand the relationship between the evaluation point and the procedures. Thus, applied Q & A provides linkages with the online video textbook and online test sheet. Throughout the flow of testing, rookie staff can enhance their understanding of the evaluation point and linkage of procedures, as in Table 1, to solve current problems.

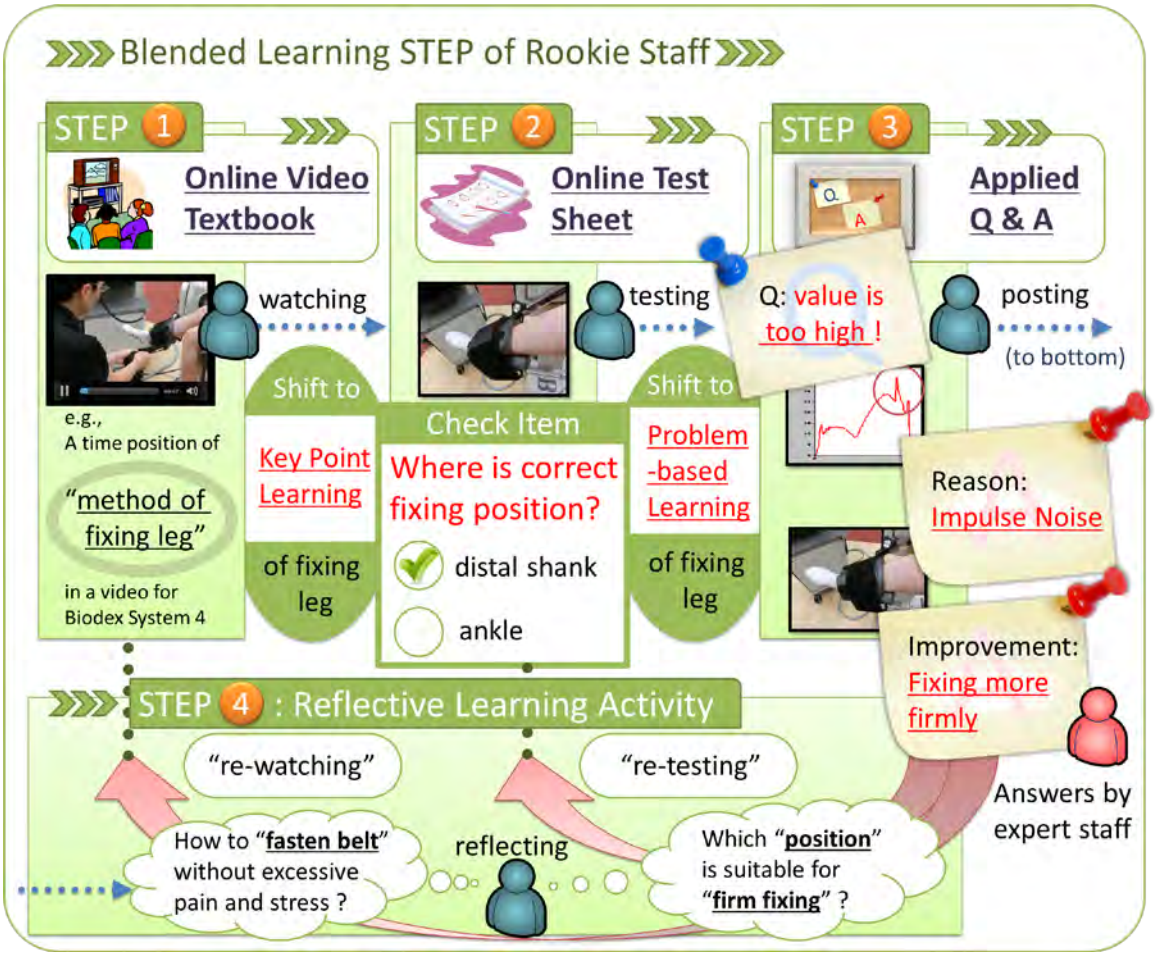

Figure 10. Example of flow regarding self-learning with CMS services

5. System Configuration

5.1 Overview of server and client system through web interface

Figure 11 illustrates the overall system configuration between a CMS server and the client PCs. The server provides HTTP Service by Apache. All staffs can utilize CMS on the web interface through a browser. Essentially, however, the server is accessible on a closed network via private LAN or Internet with VPN. This is because, presumably, limited client PCs, permitted to handle personal data, can only connect to the server. CMS is developed with an open source named WordPress as the fundamental environment. WordPress is a typical and widespread CMS used for blogging in social network services. Therefore, many people, including rookie staff, are familiar with the front-end GUI, with the exception of the system control GUI such as administrator pages. Moreover, official or other developers have released various plug-ins and provide an extension method with a programmable plug-in that has several PHP frameworks. The following proposal functions are implemented as the module.

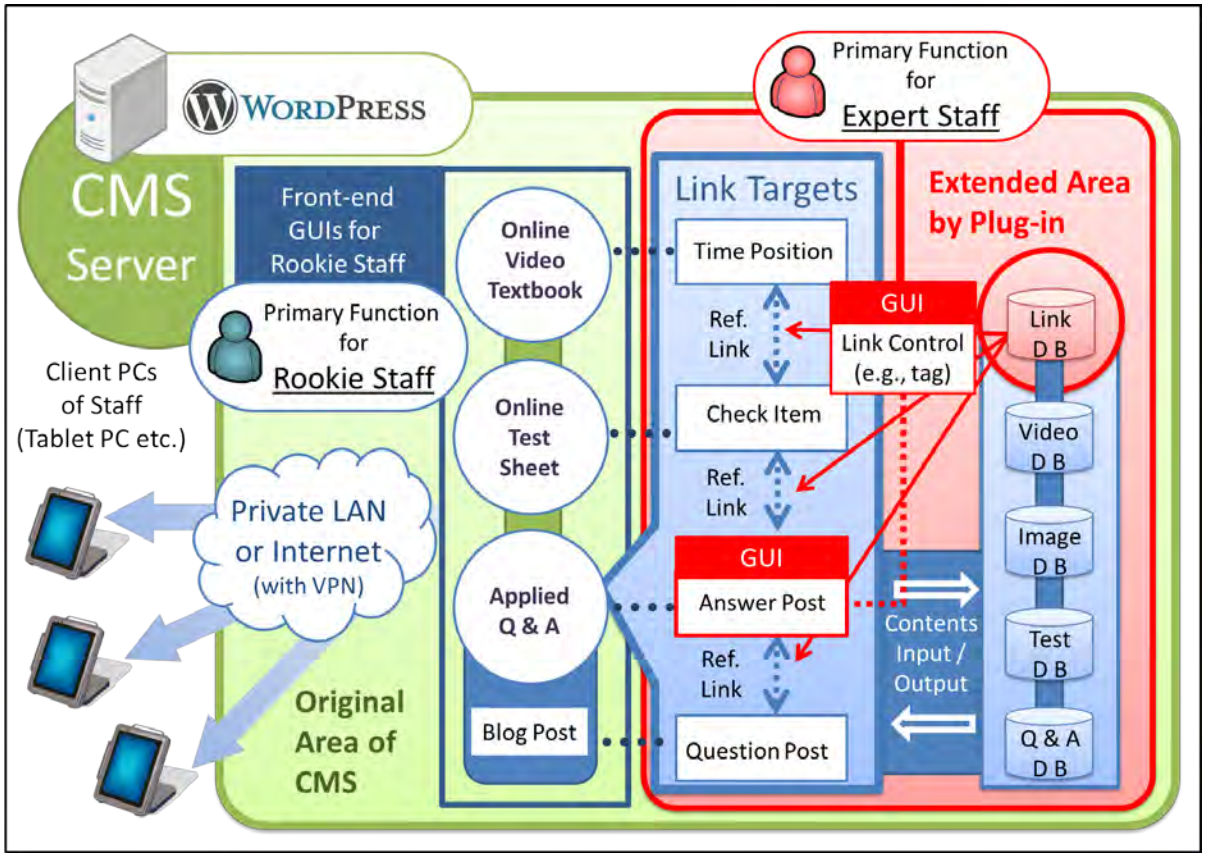

Figure 11. Overall system configuration including server and clients

5.2 Primary function for rookie staff

From the viewpoint of information literacy and for user-friendliness, all action by rookie staff would be within the front-end GUI. The almost internal architecture of CMS services without relational linkages between services is based on the original function of CMS, similar to a blog post. Both video play and test services are also constructed and customized by distributed common plug-in. On this basis, the function enables rookie staff to concentrate on self-learning and self-practice.

5.3 Primary function for expert staff

In contrast, expert staff at JISS generally have a sufficient level of literacy, but are extremely busy at work. Therefore, expert staff members have a limited amount of time to produce learning materials, and they mainly use an exclusive front-end GUI, similar to the administrator page from short-term efficiency for one-to-many rookie staffs. We will develop the GUI based on the extension module and an additional relational database of MySQL. Using the GUI, expert staff can add reference linkages as reflective learning materials, in addition to answering posted questions. Expert staff will have indirect roles as “learning navigators” during the rookie staff’s reflective stage in self-learning, as illustrated in the lower part of Figure 9.

Moreover, these linkages are built effectively with a short code framework. Once a certain rule of short code is preliminarily defined, expert staff can easily create a flexible reference linkage in a text form like WYSIWYG. Speaking more concretely, the staff can create a simple, logical program with a placeholder and a conditional placeholder with a short code framework. For example, an expert staff member can control an automatic display of recommended linkages that enable deep learning, along with the individual results of online test sheets.

6. Summary

By introducing CMS to support the staff training program for athletes' fitness testing, rookie staff can be expected to learn quickly and improve their proficiency effectively and efficiently. Furthermore, a problematic case collection system, based on PBL, can be helpful to both rookie and expert staff. Finally, this system can expand to support the solution of problems occurring in actual fitness testing.

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References

Australian Institute of Sport. (2014). Quality assurance. Retrieved from: http://www.ausport.gov.au/ais/sssm/quality_assurance

Japan Institute of Sports Sciences. (2014). Research project of sports science and medicine. Retrieved from: http://www.jpnsport.go.jp/jiss/gaiyou/jigyou/tsc/tabid/254/Default.aspx

Majima, Y., So, Y., & Seta, K. (2006). Framework for Problem-Solving Based Learning in Nursing Domain: A Practical Study. *Proceedings of the 2006 Conference on Learning by Effective Utilization of Technologies: Facilitating Intercultural Understanding*, pp. 625-628.