Proposal of a Methodology based on Organization of Learning Material including Multiple Perceptions for Knowledge Communication of Physical Training

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Abstract

Our research focus on making a new e-learning framework that supports learning to skills of physical activity. Generally, when we practice sports, we can use a learning material including multiple perceptions (e.g. coaching video with onomatopoeia). Additionally, the feedback with three-sense (e.g. sound) exception senses of taste and smell is usually effective. Moreover, using the learning material that adopts to difference of individual learning environments which the player must practice own-self (e.g. preference of the material) is enable to realize the skill learning that players can acquire the skill for own-self. We propose a learning methodology that the player can choose the candidates of learning material based on three-sense to realize a personalized and reliable training media through trial and error. The system obtains players’ movements through wearable devices with sensors during each training, and gives feedback as coaching trigger adapts to the player’s favorite perception in real-time.

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1. Instruction

Generally, in field of physical training, it is very important for communicating skills to the learners that learning materials include multiple perception signal(e.g. sound) which is not based on only text, and learning method which applied the materials to a skill training. When a learner train the physical training, the candidate of requisite perceptions depends on the material feature of the target skill. If between the perception signal and a communicating information (e.g. timing) are adequately related, it is possible to be able to learn motion skills without face-to-face coaching. Therefore, it is important that a coach provide a suitable type of the perception to the learner and the learner is associated with the coach.

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A study of Gotoda et.al. (2013) focus on the shoot-timing of tennis. In the study, they used vision, and transmit some timings. As another study, Tamura et.al. (2014) tackle to learner’s motions of baseball pitching. The study uses 2-D motion image as visual feedback. However, according to each study, the goal of skill learning is defined on either a self-evident strategy or strong assumption. These studies not focus on organization of learning materials. In other words, the condition of support is fixed (e.g. self-evident goal of traditional sports) in these research. On the other hand, there are various sports over the world and sports have been creating and deriving from another sports. For example, new sports using various new devices (e.g. drone, smartphone and wearable device) have been born all over the world. Nojima et.al. (2015) proposes “augmenting dodgeball by adding digital elements to a traditional ball game”. The new sports become temporary minor, but they have possibility that they become develop in the future. However, coaching methods for these sports have possibility that the methods preparing are late. So, the methods preparing are needed. If a frame work that develops the material through trial and error for nothing materials sports, it has possible to be able to promote development of the sports and contribute to adjust the learning materials about the sports. Therefore, this research proposes a system that connect the players and make they create the material through trial and error.

Recently, variety wearable devices become available at low-cost. The authors can use the wearable device for objectively observe the players. The reason why is that it has several sensors. The sensors are possible to detect the physical movements of learners with some physical quantity such as gravity and acceleration during the sports activity. Moreover, the devices can collect the physical movement as activity data, and apply the data to both creating the material and giving feedback to the learners.

Thus, this research proposes a learning support system which realize both methodologies that provide the preference perception for the feedback of the learners and create the material from the activity data. The creating material methodology includes methods to organize the learning material. When they create the learning material, the methodology makes the players conscious of relation of information that each players are focusing when they apply the learning material. The system obtains players’ movements through wearable devices with sensors during each training, and gives feedback as coaching cue adopts to the player’s favorite the perception in real-time.

2. Related works

A study of Matsuura et.al. (2009) proposes “a web-based community environment” for the joggers. The research shows a possible that if the system adopts to construct the community of learners, it can provide motivation to training for the learners. A study of Yamada et.al. (2014) propose a system which is possible of providing a real-time feedback to learners. The system using a motion capture to obtain the learner’s postural, and the system shows result of own motion from the recently postural of learner with vision as a feedback. The system has an advantage point which can accuracy obtain the motion and postural of learner. However, the motion capture is expensive for the individual learner. Therefore, if the motion capture can be replaced with the wearable device, it is possible that a large number of learner can employ the system as a learning support tool. Thus, this research proposes a learning support system which realize a methodology to create learning material and provide feedback signal which uses multiple perception. The methodology includes methods to organize and recommend the learning material. When they create the learning material, the methodology makes the players conscious of relation of information that each players are focusing when they apply the learning material. The system obtains players’ movements through wearable devices with sensors during each training, and gives feedback as coaching cue adopts to the player’s favorite perception in real-time. When the system uses these feedback, it is important that the feedback perception is associated to the motion. To realize that, verbalizing the motion is needed. For instance, a study of Hashimoto et.al. (2015) is exists. The research develops a system which supports drawing the form and verbalizing it. In this research, it has possible that the system can adopt the method like that to verbalize the motion and connect the motion and feedback signal.
3. Adapted material of perceptual learning for new sports

3.1. Target knowledge and skills for new sports

This research focuses on acquiring motor skills which are decided by players to improve playing sports. One of the example of skill is the movement of a player’s arm to hit a ball with a tennis racket.

The knowledge related to the skills is constructed mainly from two types. The implicit knowledge is obtained by the learners through playing their target sports, and it is based on both the experiences and senses of learner (e.g. release ball timing). If amount of texts related to explicit knowledge are either less or none, the learners should create them before train the target skill. But Creating the texts is very high cost from the view point of summarization. Moreover, if they use text-based learning material, it is difficult to communicate the implicit knowledge to the learners with the texts than face-to-face coaching. Therefore, the authors try to communicate the implicit knowledge such as timing to the learner using the feedback with the perceptual signal.

3.2. Perceptual learning scenario for implicit skills of new sports

Process of the learning in order to acquire the skills of sports are composed several steps. Fig. 1 shows the difference of learning material collection between learning processes of traditional and proposed method.
physical movement at next step, as training contents between the learners. The contents are evaluated by the learners, and the system organize the material from the result of evaluation.

When the learner train the target skill, the learner probably train with a coach at the traditional sports. The authors call this learning style face-to-face learning. The coach refers to the material to teach and to judge achieved level of the learner’s skill on the target skill. The learner can get cues which shows better timing to start action, from a coach. So, the learner can easily acquire the skills. On the other hand, when the learner trains the new sports, there are a few probability of chance for training with a coach. So, they should learn own-self. The authors call this learning style self-learning. The learners should train the skill without the cues from the coach. Moreover, the learners decide own skill level using the created material at the second step. This training style is difficult for the novice learner. The reason why the learner may not imagine detail of some action point (e.g. timing of grabbing racket) of target skill, so the novice learner needs cue and judge from the coach. Therefore, this research focuses on providing a feedback which the learner can acquire the skills easily than conventional self-learning using the wearable device. To provide such feedback, the learner equips the device on the body of learner. The device collects the learner’s physical movement, and provide cues with physical signals (e.g. sound and vibration) as the feedback. If the learner uses this device, the learner can obtain cue to start action without the coach. Therefore, it has possibility that they can imagine the detail of the skills easily. Thus, the system can communicate the implicit knowledge to the learner.

This research’s learning scenario adopts feedback system with perception information, and supports the player, because the feedback system has possible to improve training effect such that training terms become more shortly.

3.3. Communication between players through flexible materials to establish community

In the system, communication means an indirect communication through the system. First, the players evaluate each content of training between them to create the material for gain a skill. These contents are submitted by another learner. Here, the players communicate through the submitting training content and the evaluation. This system retrieves the perceptual material from a person which has it and give the perceptual material for the player that the perception is preferred instruction style of the learner. Moreover, the system logs information for exchange the material, and when the perceptual material is fit to the desirable player, the system links “consequent creator” who of the material and user of it. In this way, the system makes the players to communicate.

4. A Methodology of retrieving and organizing learning material

This paper describes the learning steps both the traditional sports and the new sports, and the contents of each sport have difference of the material collection. The system mainly support the learners to obtain the skill of new sports. Fig. 2 shows construction of the system. In this system, the learner equips the wearable device to both collect the learner’s physical movement and provide the feedback signal. The system is constructed by two parts. One of the parts is learners side, and the other is server side. The learner requests the material to recommended the learning material server with the learner’s preference from the learners side. The server treat the feedback signal based on the preference of instruction method (e.g. voice). The system converts the training contents to the timing list. The system generates the timing list to provide feedback from the content. The learner obtains the material which is composed the feedback signal and timing list. The learner installs the material to the device, and start the short-term training. The learner obtains the feedback signal such as sounds, light and vibrations according to the physical movement of learners. The movement is detected by the sensors in the wearable device during the training. If the learner feels the feedback do not fit for own-self, the learner change the preference, request the material again. This process is the trial and error part of the system. When the learner finishes the training, the device uploads the contents to retrieve and judge the contents server in server side. The server assesses the learner’s contents according to the problem list for the target skill, and mark the achieved problem in the list. The system also submits the contents to the training contents list. The contents on the list are shared to others learners and evaluated by them. The result of evaluation is submitted to the list, and the content which has the highest evaluate value is used to create the material.
5. Conclusion and future work

This research focuses on supporting the new sports. This paper proposes the sports learning system that uses perceptual material. In this paper, the authors propose a new learning methodology. The methodology is based on organizing learning material which includes information of perceptual type. It is constituted by three-senses that are the sense of sight, hearing, and touch.

In the future, the authors develop the system which proposed in this paper, after that experiment the system to confirm the effect.

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