

Teachers Learn “Action-oriented Learning” by Applying “Action-oriented Learning”

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Abstract: Action-oriented Learning (AOL) is a pedagogic approach that defines the role of teachers in supporting self-directed acting and experiential learning in authentic situations on the part of the learners. As a result of AOL, learners are expected to have acquired not only skills and knowledge laid down in qualifications, unit standards and skeleton curricula, but also technical, individual, methodological and social competences and attitudes. Applying AOL to professional learning and training has to go beyond a reform of the professional curricula in terms of content and methods but also needs to provide advanced training of the pedagogical personnel in the vocational education to be able to use this method of teaching. To help teachers to learn and apply AOL, we developed a web-based learning environment with a training curriculum that addressed the situated nature and blended learning. In this paper, we present the development of our web-based learning environment and the training curriculum. Through a pilot study, the technical feasibility of this learning environment and the usability of the training curriculum are demonstrated. The results reveal that it is effective that teacher acquire action competences of AOL by adopting the approach of AOL.

Keywords: Action-oriented Learning (AOL), Vocational Education and Training (VET), Learning Arena, Work-process-oriented Curriculum (WPOC), and Learning by Doing (LbD)

1. Introduction

In Germany, a reform in 1996 introduced a work-centered and competence-based turn in the school-based component of dual vocational education and training (Spöttl 2008). The reform removed the concept of subjects and replaced them with the concept of learning arena (Lernfeld in German) (Fischer and Bauer, 2007). Since the learning arena was introduced as a structural principle for the framework curricula, Germany’s tradition of discipline-based vocational school curricula is to be replaced by a system which prioritizes the work process characteristic of an occupation as the focus for curricula structured around learning arenas, called work-process-oriented curriculum (WPOC) (KMK, 1996). Learning arenas are didactically founded equivalents of vocational spheres of activities that are handled at school. Such learning arenas are made up of complex tasks, which are then handled pedagogically using action-oriented learning (AOL) situations (Gessler, 2017). Various theories and development trends were taken up in this regard, such as action-theoretical approaches (Aebli 1993), the process-orientation of Lean Management (Womack et al. 1994) or other reflections on situated knowledge and learning (Lave and Wenger 1991).

Although it is still important to acquire technical knowledge, abilities and skills in a WPOC, it is even more important to acquire professional action-oriented competence (Rauner 2007). According to Arnold and Kraemer-Stuerzl (1996), professional action-oriented competence is generally understood to comprise a bundle of four elements: a) Technical competence as the ability to handle complex technical tasks successfully by applying technical knowledge and skills; b) Methodological competence as the ability to apply appropriate methods and strategies for handling a task or solving a problem; c) *Social competence* as the ability to interact with other people appropriately and to communicate and cooperate successfully with them; and d) *Individual*

competence as the ability to deal critically and analytically with oneself, i.e. to critically evaluate and question one's own knowledge, abilities and skills and to take action, where require to acquire better qualifications. Via WPOC, the ultimate goal of vocational education has been “competence to act”. This ultimate goal led to the formulation of an action-oriented education as a didactic guiding principle (Gessler, 2017). “Action-oriented” is a form of learning in which not only knowledge is “accumulated” in the head, but in which the learners “think and act”. Within the framework of AOL, the focus is no longer on the educationally efficient presentation of knowledge that the learner “consumes”, but on a complete process of work including planning, executing, and evaluating active and target-oriented activities while also being aware of inter-disciplinary aspects (Rauner, 2007).

The German dual VET system has been introduced and adopted in many countries (Euler, 2015). At the beginning of the new millennium, the concepts of WPOC and AOL were introduced in China (Zhao & Xu, 2008). However, the WPOC and AOL practice is still far from being widespread and widely adopted. One of serious impediments to WPOC and AOL diffusion in VET is that teachers, with few exceptions, do not have the expertise to transform a discipline-organized curriculum into the new form of curricula and the new pedagogic approach, because they have no or less knowledge about work-process-orientation and action-orientation. It is crucial to train teachers in acquiring knowledge about WPOC and AOL and developing competences to apply the new form of curricula and the new pedagogic approach for promoting the reform of the VET. Currently teacher training around WPOC and AOL is often done in a traditional way of face-to-face, lecture-based training. Viewing the development and application of AOL as new professional competences for the teachers in VET, we propose to train teachers to learn AOL by applying AOL. In this paper we present a blended training curriculum conducted in a web-based learning environment. Via a pilot study we could corroborate that it is effective to train teachers to learn AOL by adopting the approach of AOL. In the remainder of this paper, we first characterize the AOL. Then we present a new learning environment that supports WPOC and AOL, followed by a report on a pilot study and final conclusions

2. Characterizing the Action-oriented Learning

Nowadays, the cultural-historical school of Vygotsky (1978) as well as the research based upon Piaget’s cognitive constructivist theory offer a rich theoretical basis to define specific learning methods. In this sense, the principle of action orientation inherent in Piaget’s theory becomes is the basis of a specific approach to learning by problem solving. Within the framework of AOL, learners should act independently and autonomously as often as possible. Self-management and autonomous organization are important characteristics of AOL (Baethge and Baethge-Kinsky, 1995; Hortsch 1999). An attempt is made to abandon the direct influencing of the learner through “exposition” on the part of the teacher. It is assumed that education and learning goals and processes can be made most effective if the learning environment is structured in a way as to allow the learner to interact independently with the learning content and the problems at hand. Teachers continue to arrange the learning environment, and they are still “responsible” for the learning process, but in the form of questions and tasks for teaching purposes, assistance and advice. This should enable the learners actively to obtain new knowledge and to extend their scope of professional action-oriented behavior.

AOL is the concept of education emphasized on learning by doing (LbD). According to Aebli (1993), acting describes areas of action with a high grade of awareness and purposefulness. In this context, Aebli understands “doing” in the sense of purposeful behavior and “actions” as purposeful executions that produce a concrete result. Acting towards a predetermined end means that the learning process contains expedient objectives in the form of tasks and problems on the basis of which the learner can organize her or his activities increasingly independently. Activities geared to expectations means that the learner is given incentives and scope within theoretic knowledge and practical experience to develop her or his motivation on the basis of expected success. A distinction should thus be made depending on the mental participation between a more receptive behavior, which consists purely of perceiving and memorizing information and active doing which slots the information into place, processes it and applies it. As Hortsch (1999) stated, AOL is integral learning where brainwork and manual labor are in a balanced relation. Thinking accompanies the actions and understanding results from the experiences gained in these actions.

2.1 Model of a Complete Action

Within the framework of AOL, the design of the learning process is to be orientated towards the basic structure of human acting (complete action) that include six steps of informing, planning, deciding, implementing, controlling and evaluating (Lindeman, 2002). The learner who wants to execute an action has to begin with informing her-/himself about the precise objective of her or his assignment. The learner develops a working schedule and decides upon a mode of execution. Then, the learner implements the task according to the action plan and work decisions. As a check, it is important that learners are guided to develop and subsequently apply quality criteria. Control can be preceded by the acquisition of a control sheet. On this sheet the criteria are set up along the lines used to control them. By the implementation of work tasks measure tolerances can also be supplied here, giving the margins for the quality of the end product. Afterwards learners will evaluate together with the teacher if all stages of planning, decision and implementation went in the best possible way. Simultaneously the working routine gets inspected and all together is going to establish which mistakes can be evaded in the future (Lindeman, 2002).

2.2 Action Orientation in the Project-based Learning and the Key-text Method

The principle of action orientation is manifested in a mix of methods. Depending on learning progress and learning situation of the learners, methods have to be chosen that lead effectively to the development of professional core skills. The project-based learning and the key-text method are especially suited for that and are usually used to conduct AOL.

Action knowledge would be better acquired by means of active problem solving in project-based learning, where in addition to technical, also over-arching methodological, social and personal competences will be acquired. According to Lindeman (2002), AOL needs suitable tasks for the learner to offer chances for self-responsible and self-organized learning with processes of communication and cooperation between the learners and the teacher(s). With the project-based learning, learners are set with the task to create a product or a service. The process is supposed to activate as much skills, knowledge and abilities as possible in order to create new competences this way. Theoretical and practical contents are equally learned and correlated. The institute and the teacher provide a learning environment with all necessary facilities including the tools, the laboratory, the information corner and the curriculum. In the project, the learner has to gather the necessary information and to acquire the knowledge needed to fulfill the task. Usually learners work and learn together as a team in the project, so that they could reflect on issues faced, and to balance the conflict between job and academic knowledge (Stephens and Margey, 2015). The key-text method is directed at acquiring independently skills and knowledge. It is supposed to enable learners to plan, execute and control working activities autonomously. The key-texts available in written form are supported by key questions and assistance by the teachers. The method promotes anticipative and purposeful thinking and acting and offers the opportunity to use cooperative forms.

The project-based learning and the key-text method differ in the degree of independent working. With the project-based learning the planning rests already as comprehensive as possible with learners. In this sense the learning and working task has been phrased more overtly. The creativity of the learners is demanded as well as developing and applying autonomously new methods, with errors permitted and making them subject of reflection. In the sense of the constructivistic paradigm the project-based learning is tempting, given that it aims at the autonomous practice of the learners. However, since they still have to be taught to learn autonomously, it is advisable to link the key-text method and the project-based learning together. The didactical creative potential of instructors and teachers lies in the exact phrasing of the learning and working task. A sharply outlined task within a complex context can be phrased here with clearly defined key-texts, which subsequently open narrow action spaces for the learners, within which they learn and work. It is suited in particular for solving complex tasks, even if, due to their previous knowledge and experiences, learners are only capable of comprehending the complexity to some extent. In practical terms, they should be guided within narrow boundaries along the learning method. Only when the learners can apply the principle of complete action with all its six stages of procedure and therefore possess their instruments for methodological action, the learning and working tasks can be defined more overtly.

3. Train teachers to Learn AOL by Using the Approach of AOL

It is crucial to train teachers in acquiring knowledge about AOL and developing competences to apply the new form of curricula and the new pedagogic approach for promoting the reform of the VET. Applying the principles of AOL to train the teachers in VET, we propose to learn by taking the approach of AOL, in particular, through designing a unit of WPOC taught in the approach of AOL. This design-based process is an authentic context for learning about AOL that recognizes that design-based activities take on meaning and occur iteratively over time. In light of LbD approach, we develop a web-based, WPOC authoring and delivering environment. By taking the blended training curriculum in WPOC learning environment, teachers who lack of knowledge about AOL can be engaged in the design of a WPOC with AOL approach whereby they construct their understanding and meaning towards the topics of both pedagogy and technology.

3.1 Development of a Web-based Learning Environment for WPOC

This web-based learning environment was developed for authoring and delivering WPOC (Miao et. al. 2016; Miao and Hoppe 2017). The main objective of the learning environment is to help learners to develop competences through conducting blended WPOC. The learning environment was designed in the spirit of IMS Learning Design (Koper and Tattersall, 2005), an international e-learning technical standard. Learning design has emerged as a distinct field of research, which is concerned with the development of methods, tools, and resources for helping learning designers in their design process. By adopting an approach of a pedagogy-specific learning design language (Miao, et. al. 2014), we developed a WPOC scripting language. Using this scripting language, a WPOC, representing a learning arena, can be specified by setting values of the attributes of the learning arena (e.g., title, typical professional task description, time schedule, learning objectives, prerequisite, organization of the occupation, objects of the occupation, tools, methods, requirements of the occupation, and assessment standard) and by defining a sequence of learning situations, from simple situations to complex situations. A learning situation represents a concrete work task that provides a learning task with learning context. A learning situation is specified by setting values of attributes of the learning situation (e.g., title, learning situation description, time schedule, prerequisite, learning objectives, work organization, work objects, tools, methods, work requirements, and assessment standard) and by defining a sequence of learning activities and/or stages that consists of a set of learning activities. All learning activities within a learning situation make up a complete work process to fulfill a work task or to solve a problem. As an essential work step, a learning activity is specified by describing generic information (e.g., title, activity description, time schedule, prerequisite, learning objectives), by providing task description and key-texts with information chunk to present associated theoretical knowledge and practical experience needed for performing the current learning activity. An activity is an essential unit that specifies which role act to handle/produce which artifact(s) with which tool(s) in which work mode (individually or cooperatively) towards goal.

In order to facilitate teacher in representing a design of a learning arena, we developed a WPOC authoring tool. We design and implement this tool by making use of the Business Process Model and Notation (BPMN) standard. Based on the BPMN, this tool provides a diagram-based user interface and can be used to specify and integrate application tools used in workflow. By using the authoring tool a script can be created, stored, and retrieved. The script can then be instantiated and played using our delivering tool. If a learner starts to take a WPOC, she or he can open the web page of the curriculum with a list of learning situations, from simple to complex, according to the script. She or he can go through the curriculum one by one to complete it. When clicking a chosen learning situation, the learner can see a web page as shown in Figure 1, which has three columns: learning space, work space, and activity navigation space. The activity navigation space lists all learning activities of the learning situation according to the script. The learner is currently viewing the learning activity 2.3 that is highlight in the activity navigation bar. The learner can read key-texts with the links to learning materials in the learning space. In the work space the learner can perform activity using the application tool arranged according to the script. In Figure 1, a rich-text editor is provided for doing the assigned activity “choosing the project task” in this case. If the learner has a problem to complete the current activity, the prepared information chunks that link to theoretical

knowledge and practical experience are available. The links to the associated theoretical knowledge and practical knowledge can be defined in the key-texts, so that the learner can easily access context-related information at the proper time in the learning environment, e.g. conceptual description, operation instruction, video clips of expert demonstration, work examples, and detailed solutions. The learner can also make contributions to curriculum by adding information about theoretical knowledge and their valuable learning experience in the current activity. Moreover, the learning experience acquired during the execution of the work processes could be late retrieved, deepened and reflected as well. It is important to note that the artifact produced in one activity can be transferred to another activity as an input. The learning environment is open to integrate various application tools used in the work-processes to support learning by doing. More technical description of the learning environment can be seen in (Miao & Hoppe, 2017).

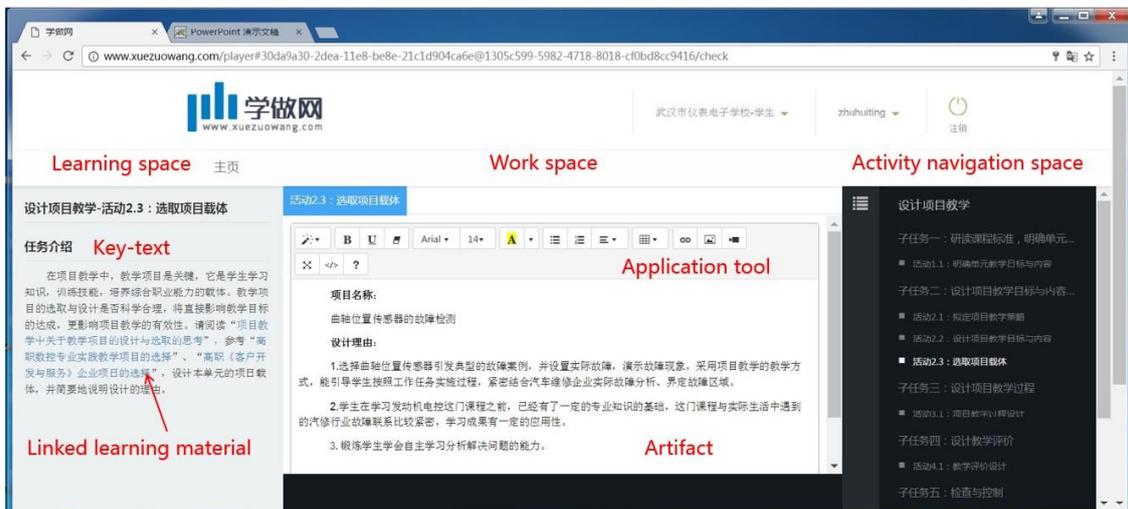


Figure 1: a screenshot of the WPOC delivering tool

3.2 Development of a Training Curriculum

In order to train in-service teachers in acquiring knowledge about AOL, recently we develop a WPOC with three learning situations. These three situations are designed and structured in accordance with the cognitive development process as three related projects. Each of them is structured as a complete action model with six stages. The objective of the first learning situation is to help trainees to have a perception of AOL. It is arranged for the trainee, who has no or less knowledge about WPOC and AOL, to experience at the first time what are the WPOC and the AOL. Considering the fact that our trainees are in-service teachers with various subject backgrounds (e.g. electro-mechanics, computer, e-commerce, and mathematics), we have to choose a commonly understandable task. We choose “writing a job-application letter” as the task of the first learning situation, because all trainees with different backgrounds are familiar with the knowledge and skills needed for doing such a task. They do not need to take too much time and efforts to learn and work on “writing a job application letter”; instead they can focus on perception of the approach of AOL. The trainee is assumed being a graduate who is applying for a job from a company. Detailed information about the graduate and the company is provided. This learning situation is structured exactly in six stages. In the first stage, trainees are informed the project task and are guided to consider and describe project ideas. They will be arranged to read two good examples of job-application letters and will be guided to analyze the learning objectives and to decompose the project task. In the second stage, trainees will be guided to identify what they should learn for completing the decomposed tasks. They have to individually consider how much time is needed for each learning task and from where they can access to the learning resources (e.g., from their teachers, peer learners, or/and internet). Then they can exchange their ideas about their working plan and discuss the relevant issues in teams and make decisions about their solutions to fulfill the tasks. In the execution stage the trainee first create a draft version of a job-application letter with a resume that emphasizes the structure of the job-application letter, main ideas, and important facts/evidences according to guidelines. More learning materials are provided in the learning space, so that the trainees can

improve their draft versions through accessing to learning materials on demand. In the next stage the trainees are required to make quality-check according to the criteria and examples provided in the learning environment. Finally, the trainees submit and present their final versions of their work and reflect on their acquired knowledge and their learning processes.

The objective of the second learning situation is to help trainees to understand AOL in depth through shifting their roles from a learner to a teacher. The second learning situation is arranged to guide the trainees to develop the first learning situation “write a job-application letter” step by step. Because the trainees just now completed the first learning situation, they do not need to take additional efforts and time to understand the project task of the second learning situation: developing the first learning situation. In such a “reproduction” procedure, the trainees are required to describe the learning objectives and learning content of the first learning situation based on their memory the understandings. Then the trainees are guided to design learning activities within the six stages of the first learning situation in the key-text method. The key-texts are mostly represented as work guidelines and questions. During the reproduction procedure, the trainees acquire action knowledge about how to develop a complete learning situation taught in the approach of AOL through undergoing the whole procedure of developing the learning situation. While reproduction, reflections take place. In this sense action and reflection are taking turns. The questions and assessment in the pedagogical sense takes as a target to expose deficits in a participative fashion and make the trainees to understand them. The longer trainees are learning with the principle of the complete action, the more they learn as well to ascertain independently their qualification deficits. The learners acquire their own way of learning that is supposed to follow the objectives supplied in the learning situation.

The objective of the third learning situation is to foster trainees, who have already basic knowledge and experience about WPOC and AOL after taking two learning situations, to develop action competences to design a unit of AOL. The project task is to choose one instruction unit of her/his own course and change it from traditional lecture approach into AOL approach. This learning situation is structured still in six stages, but the topic of the task is open. As the consequence, the final product – a unit of instruction design has no standard or correct result. However, in the activities of each stage, relevant information chunks that carry certain associated knowledge or skills are available to help trainees to carry out their decomposed tasks and achieve their intermediate goals. The trainees can discover many things on their own and at the same time learn to act independently. They are required to do cooperation in certain activities such as setting learning goals and conduct peer assessment. In summary, the acquisition of action knowledge takes place by means of active problem solving in the complete actions, where in addition to technical, also over-arching methodological, social and personal competences will be acquired. The focus of interest is not exclusively their design results, but rather decisive is the way of getting there, given that it opens the space for reflection, which is a crucial contribution to the construction of new knowledge and skills.

The whole learning process is designed as a self-managed, system-guided, and blended learning. The trainers just act as a coach and knowledge resource that can be used if the trainees cannot proceed on his own. The trainees are fostered in the processes of independent knowledge exploration and acquisition via performing activities. They have opportunities to reinforce the understanding and application of the important concepts such as the learning arena, the WPOC, the learning situation, the six-stage model of AOL, the learning activity, the working tool, artifacts and the methodology when making the instructional design.

4. A Pilot Study

To investigate the effectiveness of teacher training using AOL, the usability of the training curriculum, and the feasibility of the web-based learning environment, a pilot study has been conducted at Wuhan Instrument and Electronics Technical School. The pilot study occurred as part of a training program.

4.1 Method

All participants were in-service teachers with various backgrounds such as electro-mechanics, e-commerce, and mathematics. Most of them were newly employed and only some of them have

served as teachers in more than two years. The number of female trainees was slightly more than males. All participants were voluntary. Overall, the participants were pleased with this experience. Before the pilot study began, participants have taken two training modules to introduce basic knowledge about modern vocational education and training and instructional design, because almost all participants were not graduates from a normal college or school.

The pilot study consisted of two-phases. In the first phase all trainees took the training curriculum described above in a classroom equipped with networked computers. In fact, the trainees have been trained to use and have been familiar with the web-based learning environment in the previous training modules. At the beginning, each trainee took a pre-training test in fifteen minutes. Then the trainees conducted a self-managed and autonomic learning. They took about one and a half hour to finish the first learning situation. Then, they took one hour to complete the second learning situation. In the end of the first phase, most of them just started the third learning situation in a half hour. However, they fully understood the project task of the third learning situation before they went home. The second phase lasted ten days. During this time the trainees kept working as normal teachers in the school in working time. They continue to do their training work mostly in their free time. They were guided by the system in the key-text method to make a design of AOL unit. When they had questions and problems, they could access to the prepared learning material available in the context of application setting, discuss with their peer trainees or the trainers via the learning environment, and search for additional learning materials in the internet. Finally all trainees finished the training curriculum and completed their design work. Meanwhile, all trainees took a post-training test (answering the same questions in the pre-training test) and submitted their responses to an investigation questionnaire. Thirty-six responses were collected and thirty-five responses were valid.

The pre-training test and the post-training test are arranged to investigate to which extent the trainees gain knowledge about AOL. The test sheet consists of twenty multiple-response questions about AOL. For example, one question is stated as “Which choices belong to the stages of model of complete action?” and five choices were listed as: A) analyzing, B) deciding, C) implementing, D) controlling, and E) evaluating. The correct responses should be B, C, D, and E. If a trainee selects all these four choices and without selecting the choice A, she or he can gain 5 score. If the trainee has not selected some of these four correct choices, she or he will gain a lower score depending how many correct choices were missed. In particular, if one selects choice A, his or her score of this question will decrease one unless one’s score of this question is zero already. Thus, the score of a question is ranged from 0 to 5.

The investigation questionnaire has two parts. The first part consists of eight scale items about the training curriculum. For example, one scale item is stated as “The learning situation ‘writing a job-application letter’ is helpful to perceive the AOL?” The trainee can select one from five scales from -2, -1, 0, 1, to 2, which represents “strongly disagree”, “weakly disagree”, “neutral”, “weakly agree”, and “strongly agree”, respectively. Note that two reversed items are intentionally in case that the participant has to read items carefully before responding. For example, item 5 is stated reversedly as “in the activity the key-text describing what should do and how it should be done is not clear”. The responses for the ‘reversed’ items are then reversed before they are scored. The second part of questionnaire consists of eight open questions about their usability of the learning environment, the training curriculum and their design work.

4.2 Results and Discussion

This subsection presents the results from data analysis and discusses relevant issues. We used descriptive statistics such as means and standard deviations to analyze the data collected. Table 1 presents the results of pre-training test, results of post-training test and the improvement between the two tests. The means of the scores of all twenty questions in pre-training test are around 2.5 and those post-training test are around 4.5. The trainees improved a lot in knowledge acquisition because the average difference between two tests is about 2.0. It seems that it is also effective to master the knowledge through AOL. It is note that the deviations of the tests and the improvement are somehow large because most trainees are newly employed and some of them have served as teachers for several years. The later had certain knowledge through taking a lecture-based training in the same topics.

Table 1: Means and standard deviation of pre-/post-training tests and of improvement

Question No.	Results of pre-training test		Results of post-training test		Improvement of the records	
	Means	Std. Deviation	Means	Std. Deviation	Means	Std. Deviation
1	1.9	0.9	4.6	0.6	2.8	1.4
2	2.1	0.8	4.2	0.6	2.1	1.1
3	2.3	0.6	4.4	0.6	2.2	1.2
4	3.1	0.7	4.9	0.3	1.8	1.3
5	2.9	0.8	4.8	0.4	1.9	1.2
6	2.9	0.5	4.9	0.3	2.0	1.2
7	2.6	0.9	4.4	0.9	1.8	1.3
8	2.8	0.4	4.4	0.5	1.6	1.2
9	2.3	0.8	4.7	0.5	2.5	1.3
10	2.1	0.7	4.1	0.5	2.0	1.2
11	1.1	0.6	3.5	1.1	2.4	1.2
12	1.0	1.0	2.9	1.1	1.9	1.2
13	2.7	0.6	4.5	0.6	1.8	1.2
14	2.5	1.6	4.6	0.7	2.1	1.3
15	2.6	0.8	4.6	0.7	2.0	1.2
16	2.3	0.7	4.1	0.5	1.8	1.2
17	2.6	0.8	4.8	0.5	2.2	1.2
18	3.0	0.8	4.5	0.6	1.6	1.2
19	2.8	0.7	4.4	0.6	1.6	1.4
20	3.4	0.6	4.8	0.4	1.4	1.1

Table 2 indicates that the trainees in general weakly agree that the training curriculum is helpful for them to acquire and apply action knowledge about AOL. It also reveals that there is improvement space for documenting the key-texts more clearly and for organizing learning materials more carefully.

Table 2: feedbacks to the training curriculum

Investigation Items	Means	Std. Devi.
1. The learning situation "Writing a job-application letter" is helpful to perceive the AOL.	1.1	0.9
2. The learning situation "Designing the unit of 'writing a job-application letter'" is helpful to understand in depth what AOL is and how a unit of AOL is developed.	1.2	0.5
3. The learning situation "Designing a unit of AOL" is helpful for you to design your own unit of AOL independently through self-managed learning.	1.0	0.8
4. After taking this training curriculum, you systematically acquire action knowledge about the design procedure and the design key-points regarding AOL.	1.1	0.5
5. In the activity the key-text describing what should do and how it should be done is not clear.	0.6	0.7
6. In the activity the linked learning materials embedded in the key-text are provided on time.	0.8	0.9
7. In the activity the linked learning materials embedded in the key-text are enough for completing the activity.	0.6	0.7
8. In the activity the linked learning materials embedded in the key-text are easy to understand.	0.5	0.7

The second part of the questionnaire consists of eight open questions. When answering the question about the structure of the training curriculum as three learning situations in a thread of perception-understanding-application, thirty-two trainees thought that such a three-step structure abide by the cognitive development process. Two trainees didn't think that such a structure is reasonable. Another two have no idea about it and need further exploration. As to the three-column UI, two third reported that such a UI design is better to foster "learning by doing" with an explicit division of the space, while someone complained that learning materials cannot open on the same page and someone else expected to navigate not only to the completed activities but also to which the trainee hasn't yet started to do. In fact, the learn-flow here is not the fixed path, which activities will be performed is dynamically decided according to the individuals' performance and their roles. Almost all answers to the questions about the learning effectiveness of such a WPOC taught in AOL approach are quite positive. They reported that they developed action knowledge through designing their own unit of AOL. Some of them have been trained before in a lecture-based workshop, but they cannot make a design after the lecture. When answering to the question about the learning efficiency, the trainees have different opinions. Nearly half of them thought positive, while the remainder did not think so. Many participants complained that such training took their too much time in comparison with a lecture. In particular, few felt difficult to proceed because they have problems in self-managed learning. It is important to note that a knowledge-oriented training and a competence-oriented training differ in their goals and definitely competence-oriented training often take more time than a knowledge-oriented training. Nevertheless, most trainees thought that learning driven by making a design is more attractive in comparison with passively receiving knowledge in lecture, and they reported that AOL promotes the learning motivation and enhances interests and abilities of self-managed learning. When participants were asked whether the tasks in their design can activate the target learning content and achieve learning objectives, they thought it is no problem unless three teachers with the background in Chinese literature, mathematics, and music, respectively. Their answers to the question about applying the model of complete action in their design were divergent. Some comments were collected, for examples, "*The boundary between the planning and deciding is blurring for me when I design.*" "*The execution time is not easy to schedule and control.*" "*The implementing and controlling are overlapped in my design, so that I have to merge them.*" Regarding the evaluating stage, the participants reported that in general the objective assessment was easy to do, but subjective assessment was not easy to conduct. Many participants designed peer assessment in their unit of AOL but they felt that a lot of time and efforts were need to arrange, coordinate and conduct peer assessment. Some participants have problems to evaluate the individual contributions in team work. When answering "Are you going to apply AOL in your real-world setting according to the design of your own unit of AOL?" almost all participants were confident in the usability of their design, although some of them recognized certain difficulties in actual executions because their students may not get ready to accept it. Finally they have convergent answers to the question about advantages and disadvantages of AOL. They thought it is challenge for both the teacher and the student to apply AOL. They were sure that the students in VET would get benefits in applying AOL in WPOC. In summary, the feedbacks on the training are quite positive and encouraging.

5. Conclusions and Future Works

This paper characterized the AOL firstly. To train teachers to develop a unit of AOL, traditional lecture-based approach with discipline-organized knowledge transference is not appropriate, because developing a unit of AOL needs action competences. To promote the development of such competences, we developed a web-based learning environment for WPOC that consists of WPOC authoring tool and delivering tool. Rather than a traditional discipline-organized curriculum with lecture-based learning, a blended WPOC with AOL approach was exploited for training teachers to develop a unit of AOL. Through a pilot study, the technical feasibility of the learning environment and the usability of the training curriculum have been demonstrated. The results reveal that it is effective to train in-service teachers in developing competences to design a unit of AOL by adopting the approach of AOL. After training, all trainees have developed their own units of AOL. Most of trainees plan to apply their design unit in real-world setting.

We plan to conduct more training on the one hand, in particular training pre-service teachers after modifying the training curriculum accordingly. On the other hand, we will help the trainee to

improve their designs and to apply them in their classes. We will investigate whether their students can get benefits in competence development through using the AOL in blended learning as well.

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