Abstract
The Product-Service System (PSS) is regarded as an attractive business concept that could enable manufacturing industries to increase their market competitiveness. The range and intention of PSS design are rather different from those of traditional product-oriented design. Therefore, designers and design organizations of the future must possess new capabilities and competencies to create an effective PSS design. In this study, the authors developed an educational business game called ‘Edutainment for Designing Integrated Product-Service Systems (EDIPS)’ to enable users to become accustomed to the principle of PSS and change manufactures mindset. However, due to the complexity of the game system and its rules, it is difficult for inexperienced users to play this game without an expert EDIPS moderator who understands the game system and rules. Thus, the purpose of this empirical study is to disseminate and popularize EDIPS among design communities. In order to achieve this, this paper proposes a set of application tools and a guidebook as facilitation tools for encouraging EDIPS implementation and increasing awareness of the PSS principle among inexperienced users without the need for experts. The application tool automatically deals with a number of simple tasks in a game system. In addition, the guidebook substitutes individual responses to players’ questions while playing the game. The effectiveness of the proposed tool was demonstrated through application in a workshop conducted for inexperienced users of EDIPS.

Keywords: Product-service system, Business game, Game-based learning, Engineering education, Facilitation tool

1. Introduction

Due to the advanced commoditization of product business and intensified global competition, it has become difficult for manufacturing companies to maintain their competitive positions while using product-oriented business models. In order to resolve this issue, the Product-Service System (PSS)—which integrates tangible products and intangible services to create new added value—has received attention from both academic and industrial fields (Goedkoop et al., 1999; Tukker and Tischner, 2006; McAloone, 2011).

In contrast with traditional product design, designing a PSS offering requires the consideration of the value created by the entire system, which comprises a combination of products and services (Tukker and Tischner, 2006). Therefore, designers in traditional manufacturing companies must rewire their mindset to create and implement an effective PSS design (McAloone, 2011). For designers who have only learned traditional capital goods engineering, it is difficult to spontaneously acquire such a new mindset. This is one reason why becoming a PSS provider is not yet a common phenomenon. Manufacturing companies frequently struggle to reconfigure their business model. In order to encourage the transformation, there is a need to develop educational methods or tools that enable designers to easily and effectively adapt the new mindset (Shehab et al., 2011).

With this background, the authors of this study developed an educational business game called Edutainment for Designing Integrated Product-Service Systems (EDIPS) (Nemoto et al., 2014; EDIPS). This business game is a kind of
‘edutainment’ tool that facilitates the learning process of the PSS in an effective and enjoyable manner, through active thinking in a simulated business environment. The learning effects of EDIPS from the viewpoint of the learner are confirmed (Uei et al., 2014) on the basis of the analysis using organized learning contents of EDIPS as criteria. However, the game has a complicated system, since it represents the numerous aspects required for the design and implementation of PSS. Therefore, it is difficult for inexperienced users to play EDIPS.

In order to address this problem, this study aims to disseminate and popularize EDIPS among design communities. With this purpose, this paper proposes a facilitation tool for inexperienced users to learn about the PSS and implementing EDIPS without the presence of experts.

2. PSS design and education
2.1 Requirement for PSS design

The PSS is a concept that was originally expected to effectively reduce the environmental burden of sustainable production and consumption by bringing social structure into high-volume production, consumption, and disposal (Goedkoop et al., 1999). The PSS is also expected to enhance the value of products by integrating services throughout the product life cycle (Tukker and Tischner, 2006). Through a long-term relationship with customers, a PSS provider can continuously obtain monetary and informational value (Mont, 2002). In order to achieve this, a manufacturing company must continuously deliver value to customers by expanding the time scale in which it relates to its customers; this is done by providing services not only at the time of sales but also during the phases of the entire product life cycle (i.e., the use, maintenance, and disposal of the product). Thus, it is important for PSS designers to seek opportunities to deliver value to customers and provide appropriate services throughout the life cycle of the product (McAlone, 2011). Moreover, in the PSS, the structure for delivering value varies according to the combination of products and services. Namely, PSS designers must also explore how to continuously enhance value through a combination of product functions and service activities.

2.2 EDIPS: a business game for PSS education
2.2.1 Game concept

EDIPS is a turn-taking board game for five players (three product providers and two service providers) to help users effectively learn the new perspectives identified in section 2.1 (Fig. 1). Each player is assigned the role of either a product provider or service provider and competes to earn the highest points (i.e. revenue) to win. Players can learn fundamental PSS strategies, such as offering services for products in the market to create high added value.

2.2.2 Outline of the game

The game is roughly explained in three categories: preparation, during the game, and the end. First, each player chooses a color of product or target product color of services with which to deal at the beginning of the game. At last, the initial prices of products and services are set by rolling the dice. During each player’s turn, that player is allowed to select and conduct only one action. Actions vary according to the player’s role. Product providers can earn points when they sell their own products (three kinds of products: red, blue, and yellow). Service providers can offer four kinds of services (installation, use, maintenance, or disposal) to target products and receive points according to the phase of the product life cycle. In addition, an event phase comes every 15 minutes in the game. In each event phase, first, prices of products and services vary depending on the market situations. Then, one event card which pose uncertainty of the market as an external factor is drawn and exercised. After 90 minutes, players calculate their points. The player with the highest points is the winner.

2.2.3 Essences of the game

EDIPS has two main essences, ‘product life cycle’ and ‘PSS provider or PS (product/service) alliance’. Products sold by product providers go through the following life cycle phases: installation, use, maintenance, and disposal. Players can learn the fundamentals of product life cycles and what types of services can be offered in each phase. Also,
the rules of ecological tax and product reuse help players experience the benefits of eco-friendliness, which is one important aspect of PSS.

Each player has the opportunity to become a PSS provider by establishing a PS alliance during the course of the game. PSS providers can deal with both products and services. Therefore, PSS providers can effectively score numerous points by following their own strategy. Moreover, product providers and service providers can effectively score numerous points together in an alliance as the point is a cumulative point from each alliance member. These rules enable players to learn the importance of combining products and services to create added value.

![Fig. 1 The game board of EDIPS](image)

**2.3 Evaluation of the learning effects of EDIPS**

The authors also evaluated the learning effects of EDIPS. Here, a learning effect is defined as ‘changes in players’ cognizance through game playing’. Pre- and post-testing methods were adopted to analyse such a change. This method is suitable for achieving the objective as it can quantitatively measure both the starting point of the learning topic and the result of the experience (Ikejiri et al., 2012). In order to use pre- and post-testing as an evaluation method, First, the authors clarified the 16 evaluation criteria for the actual learning effects. Second, pre- and post-tests, which comprise the same free-question items for players (n=23), were conducted. Based on the results of this analysis, the game’s educational benefits were clarified from the learner’s viewpoint (Uei et al., 2014).

The results of this analysis reveal that EDIPS has specific learning effects. Fig. 2 depicts (a) the scoring results of the pre- and post-tests and (b) the number of respondents who provided scores for each of the learning contents. To analyze the learning effects of EDIPS, answers from pre- and post-tests are scored under evaluation criteria. Hence, each respondent’s answer is evaluated on a scale of 0 to 16. As illustrated in Fig. 2 (a), the scores increased after game playing. Specifically, the number of respondents who provided scores of zero points decreased to four. The scoring averages in each test were calculated in the following manner: pre-test 0.7 and post-test 1.9.

Fig. 2 (b) depicts the number of the respondents who answered correctly for each of the 16 evaluation criteria. In the pre-test, the score ‘1: Utilizing one’s own manufacturing ability and selling skills fully to obtain high profits with limited time and resources’ was the most common one. On the other hand, in the post-test, many respondents provided the score ‘7: Offering services considering their compatibility with products to increase profits from PSS’ and ‘13: Formulating strategies by considering market trends to increase the price of products’.
3. Research objective and method

While a certain learning effect of EDIPS is demonstrated, certain learners claimed that the game was rather complex, as it required the reflection of a considerable number of viewpoints for the design and implementation of the PSS. Students or practitioners who played this game indicated a few difficulties (e.g., ‘there are too many rules to learn’ or ‘I cannot keep up with the changes in the situation on the board’). These difficulties prevented the achievement of the original purpose of EDIPS, which is ‘learning the viewpoint required for design and practice of the PSS’.

For the above reasons, EDIPS was then implemented in the presence of a moderator, who functioned as a game master (GM) who fully understands the rules, assists players by clarifying and explaining the rules, monitors the progress of the game, responds to questions, etc. However, to disseminate and popularize EDIPS, it is necessary to eliminate the high introduction barrier and enable people to learn about the PSS design principle without the GM.

Therefore, in this study, a facilitation tool was developed to replace the function of the GM as a means to resolve the above-mentioned problems in learning the PSS design principle and implementing EDIPS. To this end, action research was adopted in order to construct more adequate facilitation tools for educating people about PSS design principle. Action research is a reflective design process of social problem-solving and involves implementing an action to study its consequences (Coghlan and Brannick, 2005). This approach uses a series of steps, each of which comprises a circle of analysis of the situation, planning, action, and evaluation as fact-finding with regard to the consequence of the action. This iterative reflective process aims to attain a certain goal by changing the situation and improving the action. In this study, a facilitation tool is developed in two cycles on the basis of the evaluation result of the learning effect obtained through the extant research described in section 2.3. Sections 4 and 5 provide detailed results of the development of the tool.

4. First cycle of the development of the facilitation tool
4.1 Analysis: function analysis of the GM

In order to develop a facilitation tool for the learning of PSS design principle and EDIPS implementation, it is necessary to identify features that can be replaced by the facilitation tool. Thus, first, the functions that the GM fulfils during the EDIPS play were analysed. Specifically, this step visualized the play actions of a game player in EDIPS, as presented in the flow chart. Further, in order to more easily grasp the functions of the GM, a hierarchal function model was constructed, which organizes the functions included in the flow chart.

As a result, four stages are described: preparation, product provider turn, service provider turn, event phase, and rule explanation. This makes it possible to grasp the aspects facilitated by the GM in each play situation.

Based on the flow chart provided above, it is evident that the GM advises whether or not to execute a particular action in every turn for each candidate action. In addition, it is also revealed that it is necessary to calculate the point scores and perform the processing task, such as moving blocks and cards on the board in both the product provider and service provider turns. When calculating the point scores, since the points paid and earned by each action are different, it is necessary to bear in mind the difference in the profit and burden of each action. This causes a non-learner who is in charge of the GM to become more confused due to various simultaneous tasks during a turn. On the other hand, with
regard to the event phase and advance preparation, unlike the product provider/service provider turn, the GM is responsible for explaining the rules of the game to all the players. Therefore, the responsibility of the GM is greater than that of the product provider/service provider.

Next, in addition to the functions of the GM that were ascertained from the flow chart, a hierarchal function model (Fig. 3) was constructed that includes other functions, like answering questions for players, which could not be included in the flow chart. Consequently, the function of the GM is roughly divided into ‘moderation of the game’, which is described in the rule book, and ‘response to the player’, which is not described in the rule book. Processing tasks such as movement of product blocks corresponds to ‘moderation of the game’ and explanation of rules in reply to questions relates to ‘response to the player’.

From the above account, it is evident that it is necessary that the facilitation tool replace two functions of the GM—that is, a function for automatically executing various processing tasks and a function for individual correspondence to the player.

![Hierarchal function model of the GM.](image)

**4.2 Plan: specification of the facilitation tool**

Based on the analysis in section 4.1, It is considered that an automatic processing tool is appropriate for substituting the function of ‘moderation of the game’. An application tool can perform automatic point score calculation by a simple operation as well as provide a clear visual explanation, with images and videos.

On the other hand, it is also necessary to deal with players, for example, to provide responses to questions even while the game is in progress. However, it is difficult for an application tool to simultaneously implement a ‘response to the player’ function. Thus, a guidebook is appropriate candidate aids, as it can be referred during the game and able to provide response to player.

Based on the above discussion, it is evident that the facilitation tool proposed in this paper consists of an application tool which automatically deals with a number of simple tasks as well as a guidebook which substitutes individual responses to players’ questions.

**4.3 Action: development of the facilitation tool**

**4.3.1 Application tool for the moderation of EDIPS**

The proposed application tool mainly supports advance preparation of the game, facilitation of each player’s turn action and event phase, management of time and point scores, as well as provision of an EDIPS tutorial. Fig. 4 illustrates an execution example of this tool. The application tool supports the moderation of EDIPS by encouraging the processing tasks to be performed at the beginning of each turn. In addition, it displays selectable actions according to the player’s current point score. This function enables players to receive instructions related to tasks, such as movement of blocks and calculation of points.
Moreover, this tool enables the measurement of lapsed time and automatically shifts to the event phase at an appropriate time by implementing the time management function. With regard to the management of the point scores, the calculation is performed automatically and players are instructed to pay or receive the appropriate points. The proposed tool also provides a tutorial before the game begins. In the tutorial phase, this tool provides an explanation of EDIPS rules and application tool operations as well as provides a game test play with videos.

With the above functions, this application tool not only enables a player to understand the basic outline of the rules and actions that can be executed, but also supports the smooth execution of a large number of processing tasks.

![Execution example of proposed application tool](image)

**Fig. 4 Execution example of proposed application tool.** The screen on the left-hand side is an instruction screen for players that indicates which player must perform which action next. The screen on the right-hand side displays an action menu for a player to select an action at his/her own turn.

### 4.3.2 Guidebook for responding to players’ questions

This study also develops an EDIPS guidebook (Fig. 5) that enables the provision of individual responses to players even while the game is in progress. In addition to a simplified rule explanation, this guidebook summarizes the correspondence between the PSS principle and game systems and answers frequently asked questions. Consequently, by replacing the question response of the GM, it becomes possible to resolve the players’ questions that may arise during EDIPS execution without hindering the progress of the game.

![Proposal guidebook for responding to players’ questions](image)

**Fig. 5 Proposed guidebook for responding to players’ questions.**

### 4.4 Evaluation: application to an EDIPS workshop

#### 4.4.1 Setting

In this study, the effectiveness of the developed facilitation tool was validated by conducting a workshop. In this workshop, 10 inexperienced students played EDIPS; they were divided into two groups: Group A, which was facilitated by the facilitation tool, and Group B, which was facilitated by the GM. After finishing the game, the participants were asked to fill in a questionnaire and the responses were compared in order to evaluate the substitution potential of the
facilitation tool. Table 1 presents the items of the questionnaire constructed in this verification. The questionnaire set the evaluation items Q-1 to Q-10 based on the functions of the GM, which were revealed by the hierarchical functional model constructed in section 4.1. The workshop participants evaluated the degree of achievement for each item on a scoring scale of 1 (minimum) to 5 (maximum).

| Q-1          | Ease of understanding the rules explained in the tutorial phase |
|--------------|---------------------------------------------------------------|
| Q-2          | Descriptions of possible actions for each turn                |
| Q-3          | Smoothness of advance preparation for games                   |
| Q-4          | Placement of the product blocks in appropriate positions      |
| Q-5          | Placement of the service cards in appropriate positions       |
| Q-6          | Judgement on competitive advantage among services             |
| Q-7          | Point score calculation and distribution                      |
| Q-8          | Smooth implementation of event phase                          |
| Q-9          | Rapid resolution of player’s questions                        |
| Q-10         | Learning experience of the PSS principle                      |

### 4.4.2 Evaluation results

Fig. 6 depicts the average points of the evaluation given by each group. Group A—which executed EDIPS with the proposed facilitation tool—evaluated Q-1, Q-4, Q-5, Q-7, Q-8, and Q-9 with a higher score than Group B. In other words, it turned out that these items can be substituted by this tool. Meanwhile, for Q-2, Q-3, Q-6, and Q-10, the evaluation scores given by Group B—which played the game with the GM facilitation—was higher than those given by Group A. In the next section, the effectiveness and weakness of the proposed tool is discussed on the basis of this evaluation result.

![Fig. 6 The result of evaluation of the proposed tool.](image)

### 5. Second cycle of the development of the facilitation tool
#### 5.1 Analysis and plan: reflection of the GM function model

The evaluation results in the first developed facilitation tool (FT1) were analysed and the functional model of GM was reconstructed on the basis of the result. Consequently, additional functions of the facilitation tool or functions that needed improvement were identified. This section focuses on the items in the questionnaire which were scored higher by Group B than Group A and analyses the aspects of FT1 that need improvement.

With regard to Q-2 and Q-6, ‘Descriptions of possible actions for each turn’ and ‘Judgment on competitive advantage between services’, respectively, the evaluation of the facilitation tool effect is lower than that of the GM. Hence, it can be assumed that it is not sufficient to prompt understanding with only the rule explanation video. In fact, the workshop participants indicated that ‘explanation of the rule video was fast and could not fully be understood’.

Further, the evaluation score of Q-10, ‘Learning experience of the PSS principle’, was relatively low for both Groups A and B compared to other evaluation items. This is a problem that is inherent in EDIPS, which was revealed
through this workshop. This problem represented the lack of a framework for acquiring a learning experience related to the PSS principle due to the excessive pursuit of the enjoyable game character of EDIPS.

It can be stated that FT1 could not sufficiently substitute the GM’s function in terms of ‘Explanation of EDIPS rules’ and ‘Supporting understanding of PSS principle in EDIPS’. To address former issue, it is necessary to add a function to explain the details of each action in order to improve the understanding of players. Further, the responses to questions in FT1 were took time and effort for the player to resolve his/her doubts, which hindered smooth play. Thus, it is necessary to add a function that enables a smooth response to questions. With regard to latter one, participants indicated that the correspondence of actions and events in the game with real world business situations is vague. Thus, it is necessary to add a function to enable a clearer understanding of ‘correspondence between real business and the game system’.

Fig. 7 illustrates a reconstructed GM function model. The main function of FT1 was ‘moderation of game’ and ‘response to player’. On the other hand, a clear explanation of rules was more important than ad hoc responses to questions. Thus, ‘rule explanation’ was set as one of the main functions. The facilitation tool developed on the basis of the reconstruction result (FT2) is described below.

Fig. 7 The reconstructed GM function model. The area indicated by the red rectangle indicates a modified function.

5.2 Action: development of the facilitation tool
5.2.1 Application tool for tutorial

In the second development, three functions—‘explanation of each action’, ‘test play’, and ‘explanation of correspondence between real business and the game system’ are added to the application in a tutorial mode based on the reconstruction result of the GM function model. The tutorial mode plays a video that provides an explanation of the rules and how to actually take action on the game board. Moreover, in this version of the tool, it is also possible to promote the visual intuitive understanding of the game process and its rules by iteratively conducting a test play between each tutorial video (Fig. 8). Fig. 9 depicts an execution example of the tutorial mode. Players receive an explanation of the rule (Fig. 9 (a)) and are simultaneously instructed to select the corresponding action on the operation screen (Fig. 9 (b)). It is possible to understand the game system through actions and operations presented in the instruction video. Further, the videos explain how the game system corresponds to real business situations in parallel with the explanation of rules. This function encourages players to understand the correspondence between each game action and real business situations.

Fig. 8 Configuration of the tutorial mode.
Fig. 9 An execution example of the tutorial mode. (a) is a tutorial video that explains players’ actions when selling their own products, and (b) is an operation screen which instructs players on actual behaviour on the application tool.

5.2.2 Improvement of the guidebook

The functions of ‘rapid elimination of questions’ and ‘explanation of correspondence between real business and game system’ were added in the guidebook. In FT1, players were unable to solve their questions due to the inconvenience of the paper-based guidebook, which did not help them to understand and solve questions efficiently. Therefore, the Q & A part in FT1 is digitized in FT2 as a question search tool in order to shorten the time required for searching for Q & A. Two search methods—category search and direct search—were implemented in this search tool, as depicted in Fig. 10. Players can search for questions from among 12 categories (concepts of EDIPS, action, etc.). This function supports the Q & A search by the player whose question is ambiguous. Direct search makes it possible to search input keywords by partial match search and is effective for players whose question contents are predetermined. Moreover, this tool enables players to recognize corresponding relationships with actual business at any time by adding not only questions related to game rules but also those that correspond with real business to the Q & A list.

![Question search tool](image)

Fig. 10 Question search tool.

5.3 Evaluation: application to an EDIPS workshop

5.3.1 Setting

In this study, an EDIPS workshop was conducted using FT2 in order to validate the effectiveness of the proposal. In this verification, 10 inexperienced students were divided into Group A, which used FT2, and Group B, which used FT1. After the workshop, the participants were asked eight questions on ‘rules of EDIPS’ and the ‘PSS principle’. Finally, the effectiveness of the proposed tool was evaluated by comparing the number of correct answers. Questions on ‘rules of EDIPS’ led to representative questions that were frequently asked by players in the verification of FT1. Questions related to the ‘PSS principle’ were extracted from the learning contents provided at the EDIPS development stage (Nemoto et al., 2014). Table 2 presents the question items in this verification.
Table 2  Question items on the rules of EDIPS and the PSS principle.

| Rules of EDIPS | PSS principle |
|----------------|---------------|
| Q-1            | Q-5           | How is the service competitiveness in the market calculated? |
| Q-2            | Q-6           | What is the mechanism of product price fluctuation? |
| Q-3            | Q-7           | How is the interaction between product provider and service provider in an alliance partnership? |
| Q-4            | Q-8           | How is the inventory of products managed? |

**Table 2**: Question items on the rules of EDIPS and the PSS principle.

**5.3.2 Evaluation of results**

Fig. 11 illustrates the number of respondents who correctly answer the questions presented in Table 2. With regard to the understanding of the rules of EDIPS (Q-1 to Q-4), the score of Group A was higher than Group B except for Q-1. In particular, the number of correct answers provided by Group A for Q-3 greatly exceeded those provided by Group B. Further, with regard to the understanding of the PSS (Q-5 to Q-8), Group A had a greater number of correct answers than Group B for all the questions. On the contrary, no one in Group B was able to answer correctly in Q-7. From the above results, it was confirmed that FT2 developed in the second cycle encouraged the players to improve their extent of understanding of ‘rules of EDIPS’ and the ‘PSS principle’, as compared with the understanding in FT1.

**6. Discussion**

This section discusses the effectiveness of the developed tool in enhancing the player’s understanding of ‘rules of EDIPS’ and the ‘PSS business principle’ based on the verification result presented in section 5.3. The results of Q-3 and Q-4, depicted in Fig. 11, proved that the function of the developed tool actually substituted the role of the GM and improved players’ understanding. For example, with regard to Q-3, all participants in Group A were able to experience the alliance that concluded in the tutorial mode. This is why there was a difference in the number of correct answers as compared with those of Group B, where the experience of the alliance was not incorporated in the tutorial.

In terms of the effectiveness of the tool to facilitate the understanding PSS principle, as shown in Q-5 to Q-8 in Fig. 11, all scores of Group A were higher than those of Group B. This result indicated that the proposed tool can substantially enhance the learning of the PSS principle. For example, in Q-6, participants in Group A had searched for the reasons why a service provider would require a huge capital investment cost to become a PSS provider by using the proposed search tool. This assisted players in enhancing their understanding related to the implementation of PSS and the necessary investment needed for becoming a PSS provider. Meanwhile, regarding Q-7, the tutorial video provided by FT2 made it possible for participants in Group A to clarify the concept of PSS, which improved business robustness through the integration of products and services.
Moreover, the proposed tool was also effective for the smooth progress of EDIPS. Group A’s play time taken per cycle (all players do their own turn) was approximately 60% of Group B, and they were able to play twice cycles as much as Group B did in the workshop (Fig. 12), whereas Group B was confused by the difficulty of the explanation of the tutorial and the inconvenience of the guidebook for handling their questions. While in order to popularize game-based learning and promote the learning experience, big consideration is given to the time constraints of players who participate in the game, and to ensure that the game-playing is trouble-free (Klopfer, 2009). Therefore, this result indicated that the proposed facilitation tool has the capability for disseminating EDIPS in the design community.

Fig. 12 The play time taken per cycle in each group.

However, this validation also indicated the presence of remaining issues, which provide directions for future research. With regard to Q-1, the number of correct answers in Group B exceeded those in Group A. It is assumed that FT2 did not explain the aspect of service competitiveness from the guidebook and only substituted the explanation with the tutorial video, whereas FT1 described this aspect. Referring to Q-2, both groups had low rates of correct answers. This is because the automation of price fluctuation depends on the amount of product distribution in the application. This function resulted in a situation where the game progressed without the players understanding the mechanism. To resolve these problems, it would be effective to develop a computerized guidebook which enables to search for and confirm the explanation of the rule with an understandable illustration.

Further, the application of the developed tool is limited to students, and verification cannot be conducted for actual practitioners. Extant research in the field of education indicated the ‘difficulty of dealing with standard curriculum’, ‘environmental/time constraints’, ‘difficulty of learning effect evaluation in organization’, etc. as barriers to introducing game-based learning into employee training (Fujimoto et al., 2016). In order to address these issues, efforts have been made to construct interactions that aim to improve the game system by acquiring recorded data and feedback on game play or providing a learning game platform that incorporates a learning evaluation mechanism. Therefore, future research could include the identification of EDIPS learning evaluation indicators and the development of game systems utilizing electronic tablet devices, etc. through application experiments for practitioner training.

7. Conclusion

In this paper, a facilitation tool that consists of an application tool and a guidebook is developed on the basis of the function analysis result of the GM in EDIPS through an action research cycle. This facilitation tool is intended to enable the implementation of EDIPS and the adaptation of the PSS by inexperienced users without help from experts. The effectiveness of the proposed tool is demonstrated by verification through workshops. Future research must include the identification of EDIPS learning evaluation indicators and the development of game systems that utilize electronic devices through application experiments for practitioner training.

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