

Demonstrative Implementation and Validated Effectiveness of Group Work Exercises Integrating Project-Based Learning and Active Learning Utilizing Digital Books: A Case Study on "SDGs/CE Business Concept Proposal" Within the Business Producers Development Program

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ABSTRACT

Our Japanese industry-university project group of Aoyama Gakuin University investigated and studied new educational programs for cultivating “business producers in a future-oriented business strategy design” for human resources over several years. To develop such new human resources, the research team has been engaged in devising new educational methods for group work exercises that combine both “Project-Based Learning (PBL)” and “Active Learning (AL)” as industry-academia joint research. The purpose of this research in 2024 AOYAMA BUSINESS REVIEW (ABR) is to consider three research issues as outlined below: (1) Addressing the benefits and overcoming drawbacks of

modifying the overall class design for group work exercises, (2) Exploring the basic specifications of Digital Books for utilization during group work exercises and their application to "SDGs/CE Business Concept Proposal" as a case study, and (3) Verification and analysis of the effectiveness of the "SDGs/CE Business Concept Proposal" group work exercise, based on test score results, questionnaire survey analysis, and evaluation of team-specific worksheet outcomes.

Key words:

Digital Books, Project-Based Learning (PBL), Active Learning (AL), Group Work Exercise, Business Producers, Future-oriented Business Strategy Design, Sustainable Development Goals (SDGs), Circular Economy (CE)

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Acknowledgments

References

1. Introduction

Our Japanese industry-university project group of Aoyama Gakuin University investigated and studied new educational programs for cultivating **“Business Producers in a Future-Oriented Business Strategy Design”** for human resources over several years [1]. To develop such new human resources, the research team has been engaged in developing new educational methods for group work exercises that combine both “Project-Based Learning (PBL)” and “Active Learning (AL)” as industry-academia joint research.

The principal of the research team (Professor Tamaki) has been engaged in two types of specialized courses for developing “Business Producers in a Future-Oriented Strategic Business Design (hereinafter referred to as "Business Producers")”, for second- and third-year undergraduate students in the School of Business of Aoyama Gakuin University from FY2015 until now. The spring class method is as follows: face-to-face lecture-type classes are carried out to teach specialized knowledge and various techniques that should be acquired in advance as preparations for the next fall semester course. The next fall class is the subject of this research, and group work exercises integrating PBL and AL are used as a class method.

The following discusses the chronological development of research findings related to the instructional methods of these group work exercises, which have been presented at AOYAMA BUSINESS REVIEW (ABR).

As an ongoing activity of educational programs for Business Producers in the 2022 ABR [2], the purpose of this research

is to develop new educational methods of "online group work exercise" that combine both PBL and AL so the methods can flexibly respond to the new normal era as a countermeasure against COVID-19. The new educational methods explored the development of educational organizations, learning support management methods, and learning environment systems. The AL of group work exercises included four different types of business roles, namely Group1: value chain management and business model, Group 2: SDGs/CE product planning and digital marketing, Group3: smart product strategy and application software design, and Group 4: multi-sided sharing platform (MPS).

As part of the measures for the post-coronavirus era, leading universities in Japan started working on their own education DX business concept starting a public offering subsidy under the Digital Utilization Education Advancement Project by the Ministry of Education, Culture, Sports, Science, and Technology (MEXT). Hybrid group work exercises by effectively utilizing educational DX technology deal with the following issues in the 2023 ABR [3]: (1) Curriculum design for hybrid group work exercises combined with PBL and AL, (2) Shared digital whiteboard and DX learning environment systems, and (3) A Q&A system using knowledge BOMs (Bill of Materials) and an AI chatbot system.

The aim of this research in the 2024 ABR is to describe four research issues as outlined below:

1. Addressing the benefits and overcoming the drawbacks of modifying the overall class design from “Parallel” to “Serial” for group work exercises (Section 2.3)

2. Exploring the basic specifications of Digital Books for utilization during group work exercises and their application to "SDGs/CE Business Concept Proposal" as a case study (Chapter 3)
3. Verification and analysis of the effectiveness of the "SDGs/CE Business Concept Proposal" group work exercise (based on test score results, questionnaire survey analysis, and evaluation of team-specific worksheet outcomes) (Chapter 4)

2. Course Design of Group Work Exercises Integrating PBL and Active Learning for Developing Business Producers in Future-Oriented Strategic Business Design

2.1 Educational Objectives in the Business Producers Development Program: Four Different Business Task Roles

In team building exercises using the AL method in the previous year, 2022, learners were separated into four project groups (Group1/Group2/Group3/Group4) with different business operation roles.

Divided into four group members within one team, engage in different group work exercises for undertaking distinct business tasks, during the class sessions from the 6th to the 13th for approximately 8 weeks as indicated in **Table 2.1**.

- Group 1: SDGs/CE value chain management (VCM) and business model
- Group 2: SDGs/CE new product planning and digital marketing
- Group 3: Smart product design and application software design

- Group 4: Multi-sided sharing platform (MSP)

(1) Group 1 SDGs/CE value chain management (VCM) and business model:

- SDGs/CE-VCM: Supply chain management and finding stakeholders (business partners) who can support each supply chain
- Building business process models to provide business and services
- Devising revenue models that correspond to the above business process modes
- Strategic Evaluation of VCM and Business Models from the Perspective of SDGs/CE

(2) Group 2 SDGs/CE new product planning and digital marketing:

- Designing personas and profiles for future customers when offering SDGs/CE new products
- SDGs/CE new product planning: Composition and features of the product, customers usage scenarios, and the psychological and emotional impact on customers during product utilization
- Promotion of SDGs/CE new products and collection and analysis of customer service usage data through digital marketing

(3) Group 3 Smart product design and application software design:

- Designing personas and profiles for future stakeholders when offering new services through the MSP and application

software

- Designing product architecture of smart products
- Determining the required specifications for application software used between two stakeholder pairs in the aforementioned SDGs/CE-VCM
- Designing the processing process of the application software used between MSP and smart products and ensuring usability for each stakeholder

(4) Group 4 Multi-sided sharing platform

- Designing required functions and specifications of MPS service through the application software between two stakeholder pairs in the aforementioned SDGs/CE-VCM
- Designing the algorithm executed within MSP for the application software used between two stakeholder pairs
- Designing the database within MSP and its utilization for collecting, storing, and analyzing application software usage data from individual stakeholders

2.2PBL Theme Setting: Conceptual Design of SDGs/CE Product Planning and Multi-sided Sharing Platform

(1) PBL Theme Setting: Conceptual Design of SDGs/CE Product Planning

The SDGs target 12.3 “reduction of food loss” and SDGs target 12.5 “reduction of waste” were involved in the SDGs 12 Goal “responsible consumption and production”. The former SDGs target 12.3 was “By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses in production and supply chains, including post-harvest losses”.

The latter SDGs target 12.5 was “By 2030, substantially reduce

waste generation through prevention, reduction, recycling and reuse”. Furthermore, this target 12.5 was related to the “Circular Economy (CS)”. The shift from a linear economy to CE required new marketing methods. The European Commission suggested that successful adoption of CE would require new consumer behaviors [4]. It was necessary to conceive a CE business and consider how to solve CE-specific social business issues.

Each team would find a social issue theme that they hoped to solve from the above-mentioned SDGs and CE perspectives, and decide on their own "SDGs/CE product planning" theme.

(2) PBL Theme Setting: Multi-sided Sharing Platform

The theme of PBL for future strategic design adopted a form of the MSP business model. This MSP business model operated a platform and application software that mediated between the “supply side” that provided products/services, and the “demand side (customer)” who wanted them. In other words, the MSP built a new business model by acting as an intermediary between the providers of products/services and the customers, as between two stakeholder pairs.

When deciding on the theme of this MSP service, each team should be involved in drafting the first group work exercise "SDGs/CE Business Concept Proposal" that would be useful in solving social issues related to the described later SDGs.

2.3 Course Design in the Business Producers Development Program Integrating PBL and AL

(1) Parallel Course Design before the Previous Academic Year 2022

Considering the characteristics of the education methods

before the previous academic year 2022, four different [Group1, Group2, Group3, and Group4] work exercises were conducted in parallel course design by applying the AL education method, during the class sessions from the 6th to the 13th as shown in **Table 2.1**.

Table 2.1: Curriculum combining PBL and AL methods [2]

No.	New educational methods	G1: Business model	G2: New product/service planning	G3: Smart product design	G4: Platform service management
1	PBL : Collaborative learning with all team members	Introduction: team and group building, learning goals for educational program of the business producers			
2		Survey of advanced cases of platform services and application software			
3		Determining the theme of new product/service planning for the “application software” of each team			
4		Creating the “ SDGs/CE Business Concept Proposal ” for platform service management for each team (1),(2)			
5					
6	AL: Collaborative learning within the same group and/or [Collaborative learning between different groups]	Own required management resources and business partners	Customer purchasing decision process	Image of service utilization of smartphones and mobile products	Required functions and specifications of platform service
7		[G1⇔G4] Business and service process model for	New application software planning	Product architecture of smartphones and mobile products	[G1⇔ G4] Platform services and application software
8					
9		platform services and application software	[G2⇔G3⇔G4] Application software	[G2⇔G3⇔G4] Application software	[G2⇔G3⇔G4] Application software
10		Improved business model	content flowchart	[G2⇔G3⇔G4] Processing	[G2⇔G3⇔G4] Processing
11		canvas with customer behavior and service processes	[G2⇔G3⇔G4] Design of each screen content transition when	algorithm for application software linked with	algorithm for application software linked with platform

			the customers use the application software	smartphones and mobile products	systems
12					
13		Revenue business model	Promotion strategy of application software as new product/service planning	Usability of application software linked with smartphones and mobile products	Algorithm of collection/accumulation/analysis of customer usage data and behavior data
14	PBL :	Submission of final “SDGs/CE Business Scheme Proposal” ⇒ Learner's grade evaluation [evaluated in terms of team, group, personal contribution]			

In the first to fifth classes in **Table 2.1**, each team formulated a "SDGs/CE Business Concept Proposal" with all team members” by applying the PBL education method.

There were two types of collaborative learning for AL group work from the sixth to twelfth classes. One way involved carrying out collaborative learning within the same group, and the other way involved collaborative learning between different groups, described, for example, by $[G1 \Leftrightarrow G2]$ in **Table 2.1**.

Then, individual teams were organized with four group members (Group1/G2/G3/G4), and active learning (AL) group work exercises corresponding to role allocations were simultaneously conducted. This approach resulted in the creation of individual deliverable for each of the four groups. Throughout approximately eight classes of the course, a deliberate effort was made to share intermediate results among different groups by incorporating steps for mutual sharing during the process of creating these deliverable.

The second session comprised collaborative learning among all team members, where various “**Deliverable WSs**” produced through the processes described in 1) and 2) were compiled into a final deliverable known as the "**SDGs/CE Business Scheme Proposal.**"

(2) Serial Course Design for the Current Academic Year 2023 and its Characteristics

Figure 3.2 illustrates the progression of the course that transitioned to **Serial Course Design** starting from the current academic year 2023.

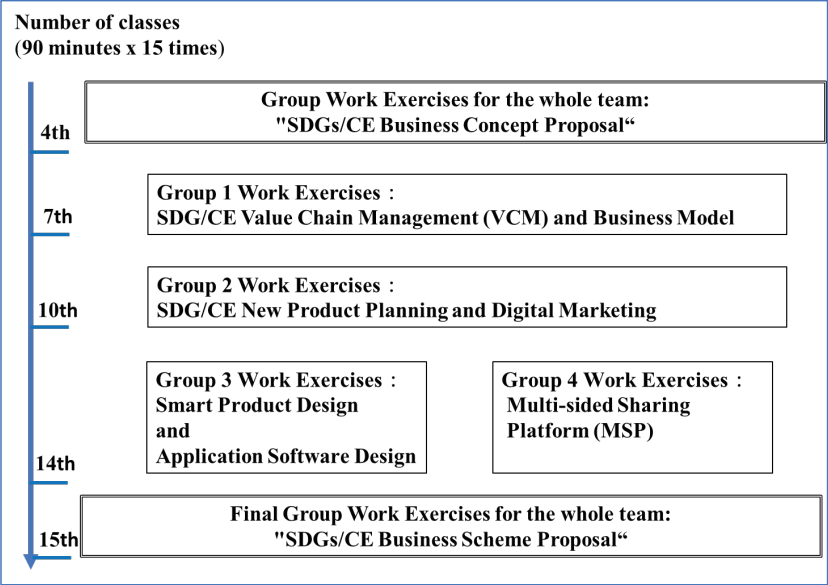


Figure 3.2 Proposal for Enhanced Overall Course Design in the 2023 Academic Year: Sequential Group Work Exercises

First, the impact of the transition to "**Serial Course Design**"

and the corresponding measures were described as follows:

- The decision was made to shift from a parallel group work exercise structure, where all four groups simultaneously engaged in different exercises, to a sequential approach, progressing through four types of group work exercises in order.
- With this change in teaching methodology, the impact was felt in the reduction of the exercise period for each group. As depicted in **Figure 3.2**, the exercise period for a single group was shortened to approximately three or four classes. Consequently, the total number of classes was reduced to about half or less.
- This reduction in the number of classes required a corresponding decrease in the course content. Specific adjustments were made by narrowing down the learning topics outlined in "2. Course Design of Group Work Exercises," with a focus on the essential items for "Serial Course Design" (underlined learning topics). Approximately 60-70% of the learning topics were retained, ensuring relevance to the new teaching structure.
- To address the challenges posed by the revised structure, the utilization of the "Digital BOOK " was to shorten lecture times and facilitate efficient and effective collaborative learning during group work exercises. The basic specifications of the "Digital BOOK" integrated presentation slides, slide commentary, explanations of keywords within the text, and case study worksheets for reference during exercises.
- Additionally, the use of a digital whiteboard, specifically "Google Drive," allowed multiple team/group members to simultaneously create deliverable WS in an online environment,

allowing collaboration during group work exercises, enabling the efficient and effective progress of group work exercises.

Second, the benefits of the transition to "**Serial Course Design**" were outlined as follows:

- By discontinuing the practice of assigning one team member to each of the four different groups, all learners could experience hands-on learning in group work exercises for Groups 1, 2, 3, and 4.
- This change was aimed at enhancing the motivation of learners.
- There had been a significant reduction in the effort required for learning support by instructors and teaching assistants (TAs).
- Previously, in academic years before the current one, a team was organized with approximately eight people per team (two people x four groups) in order to be divided into four different groups. In the current academic year (2023), the team size had been reduced to approximately six members, allowing for an increase in the number of teams.
- In previous academic years, there were instances where dropouts or absences affected specific group exercises throughout the course period. In the current academic year (2023), instructions were given to instructors to flexibly adjust the workload of the team's deliverable WS in the event of dropouts or absences (with instructions to annotate the circumstances in the deliverable WS). This directive had helped mitigate the aforementioned issue to some extent.

3. Basic Design of Exercise Worksheets and Digital Books

3.1 Three Types of Exercise Worksheets and Digital Whiteboard for Collaborative Learning

(1) Three Types of Exercise Worksheets

There are three types of WSs [3]. The first type of WS organized contents such as tables, diagrams, and explanations so that each learner could easily describe and express the results of learning with collaborative learning according to the procedure of the individual exercises. It is a WS format for descriptive expression (referred to as a “**White WS**” on which nothing is written in the format).

In the second type of WS, instructors and TAs guided case examples corresponding to the content of their respective exercises in the white WS so that they could visualize how to write the “**Case study introduction WS**”.

The third type of WS was a summary of the results of collaborative learning by each team/group in response to the assignments of the group work exercise presented by the instructor (referred to as “**Deliverable WS**”).

(3) "Google Drive" for Collaborative Learning on a Digital Whiteboard

The “**Google Drive**,” functioning as a digital whiteboard platform, was employed to create an individual “**deliverable WS**” for team/group collaborative learning in group work exercises. In preparation for the class, each team had its own “working board” within the “Google Drive” platform set up by the lecturer or TA. Subsequently, team/group members uploaded their respective “**white WS**” into their working board. After renaming the file

from "**white WS**" to "**deliverable WS**," multiple group members collaborated within the same "working board" to complete cooperative learning. Through this collaborative effort, the final submission-ready deliverable for "**deliverable WS**" was generated.

"**Google Drive**" provides features facilitating collaboration in an online platform environment. "Google Docs" and other applications in the "Google Drive" suite serve as collaborative tools for editing documents in real time. Documents can be shared, opened, and edited by multiple users simultaneously, allowing users to observe character-by-character changes made by collaborators in real time [5].

Changes are automatically saved to Google's servers, and a revision history is automatically maintained, enabling the review and reversal of past edits. An editor's current position is indicated with an editor-specific color/cursor, allowing other collaborators viewing that part of the document to see edits as they happen.

3.2 Basic Specifications of Digital Books for Group Work Exercises

(1) Usage Format of Digital Books

In contrast to traditional paper-based books, we define instructional materials designed for online use as "Digital Books" (refer to **Figure 3.1** for illustration). These digital educational resources encompass the following features:

- Lecture presentation materials.
- Explanatory text accompanying the materials, including explanations of keywords/specialized terms (designated in bold and Gothic type within the text). This functionality, which allows integration with the Learning Management System (LMS), is referred to as the "Specialized Term Wiki

System."

- Machine-generated audio corresponding to the explanatory text.
- External links from the "Digital Book" to the LMS using "QR codes" and to the web using "Linked URLs."
- Utilization of "QR codes" for LMS, enabling the download of WSs materials for collaborative learning during group work exercises, as well as the implementation of a "Quiz" and "Surveys for Course Evaluation" at the conclusion of unit themes, all facilitated through the LMS.
- On the LMS side, the storage of individual learner's response data, along with the presentation of response data for all learners in a summary table for analytical purposes.

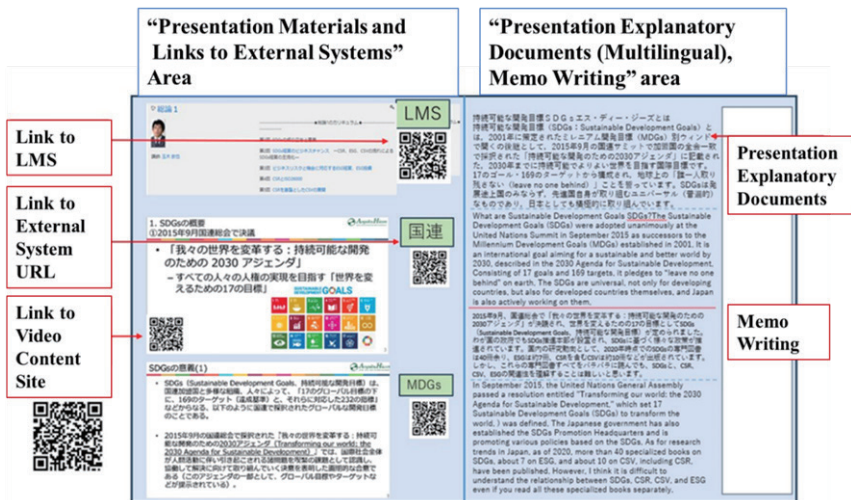


Figure 3.1 Image of Basic Specifications of Digital BOOK [6]

(2) Requirements for Basic Specifications in the Future Development

To realize the previously mentioned basic specifications, the future development, design, production, and operational management of Digital Books will need to:

- Enable seamless learning for individual learners in both the real-world scenario of an "Offline Environment Book" used on each learner's personal PC and the virtual scenario of a "BOOK" linked externally in an online environment, such as LMS and the web, adapting to each learner's usage environment seamlessly.
- Allow operations within the Digital Book and its associated external systems to be performed not only on the learner's personal PC but also on smartphones.
- Ensure that external links from the Digital Book use "QR codes" for LMS and "Linked URLs" for the web, as previously mentioned.
- Ensure access to multimedia content (audio, images, videos, authoring and playback of instructional materials) is achievable with a single click for each learner within the Digital Book.
- Integrate and manage comprehensive learning history information (learning logs) for each learner, corresponding to timestamps of learning activities. This includes the learning progress within the Digital Book, online test/survey results within external LMS, usage of the Specialized Term Wiki System, and the use of Linked URLs to external web content.
- Allow individual learners to save their learning history information (such as comments, markings on important sections, and submitted artifacts for group work exercises)

using Digital Books. This information should be exportable in formats like PDF, allowing learners to document and output their individual learning achievements for future reference.

3.3 Case Studies on the Utilization of Digital Books for the Team Exercise "SDGs/CE Business Concept Proposal"

The first step in advancing the group work exercises for the **"SDGs/CE Project Concept Proposal"** involves the entire team (comprising approximately six members per team) setting the following three themes:

- Theme setting for “SDGs/CE social issue resolution” towards 2025
- Theme setting for “SDGs/CE product planning”
- Theme setting for “Multi-side Sharing Platform (MSP)”

In this proposal, to set the three themes mentioned above, the entire team was instructed to engage in four types of group work exercises as follows:

- (1) **Backcasting Technique:** Starting from the future year 2040, going back to 2030 and then further to 2025, each team sets the theme for "SDGs/CE social issue resolution" that they should work on.
- (2) **SDGs/CE Value Chain Management (VCM) Technique:** SDGs/CE-VCM to realize the above “SDGs/CE social issue resolution” consists of the following three elements:
 - Supply Chain Management (SCM)
 - Stakeholder management (SHM) responsible for each of the above supply chains
 - Application software (APS) that connects two adjacent pairs

of SHMs among the above multiple SHMs.

- (3) **SDGs/CE Product Planning Technique:** Determine the product brand, think about the characteristics of the new product, and consider the key points of package design.
- (4) **Multi-Sided Sharing Platform (MSP) Technique:** This platform adopts the business model of a multi-sided platform (connecting suppliers and demanders). There will be multiple other stakeholder pairs on VCM, and a feature of this MSP is that it can process information from multiple APSs corresponding to each pair.

The specifications of the digital BOOK used to progress each of the aforementioned group work exercises are as follows:

- "Case Introduction WS" to introduce the image of the results of each exercise.
- "Description Procedure" for the WS.
- "Explanation related to each item in the WS along with the description procedure."

Below, the digital BOOK specifications for the (4) MSP exercise are introduced among the four types of group work exercises.

Case Study: (4) Digital BOOK Specifications for "Multi-Side Sharing Platform (MSP)" Group Work Exercise [7]

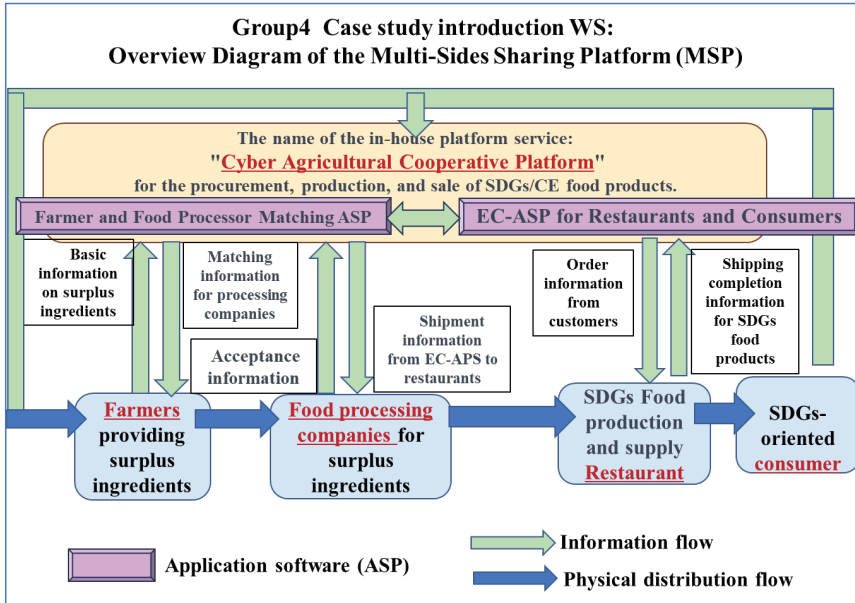


Figure 3.2 Example Worksheet for the Overview Diagram of the Multi-Sided Sharing Platform

[WS description procedure] (Figure 3.2)

1. Describe the "Platform" box in the WS and enter the "MSP type name" in that box.
2. At the bottom of the WS, describe the "stakeholders" who play the role of each supply chain (logistics).
3. Describe the information flow between the platform and stakeholders.
4. [Group 3] Describe the "APS name" prepared for each MSP stakeholder pair in 3 above.

[Explanation related to each item in WS] (Figure 3.2)

4.1 [Group 3] Explain the function of each "APS"

*When doing so, maintain consistency with the description in "4 [Group 3]: Application software (APS)" in "group work exercise 2. SDGs/CE Value Chain/APS WS".

4.2 Consider and explain what kind of information should be fed back from the final consumer to the platform and each stakeholder.

*Number the feedback information for each stakeholder, providing specific explanations.

4. Evaluation of Learner Performance and Effective Verification of Exercise Implementation for "SDGs/CE Business Concept Proposal"

4.1 Analysis and Discussion of Quiz Results for "SDGs/CE Business Concept Proposal"

To assess the understanding of the "SDGs/CE Business Concept Proposal," an online quiz was conducted using a true/false format. A total of 41 learners participated in the test. **Table 4.1** and **Figure 4.1** present the number of correct answers and the corresponding correct answer rates (%) for each quiz question.

The analysis revealed that the accuracy rate for the question related to "Group Work (GW) Exercise (2) on SDGs/CE-VCM Techniques" was in the 70s, indicating a relatively low performance. However, for other questions, the correct answer rates ranged from the 80s to the 90s. Consequently, it can be inferred that the understanding of specialized knowledge related to the **"SDGs/CE Business Concept Proposal"** generally met the educational objectives.

Table 4.1 Analysis Results of the Online Quiz on the "SDGs/CE Business Concept Proposal"

(41 Test-takers)

Quiz question format: True/False format		Number of Correct Responses	Correct Answer Rates (%)
SDGs Issues			
☐	SDGs Goal 12 advocates "Responsible Consumption and Production."	40	97.6
☒	SDGs Target 12.5 proposes addressing the social issue of "Reducing Food Loss."	34	82.9
CE Issues			
☐	The CE System Diagram includes renewable and depletable resources.	37	90.2
GW Exercise (1) : Backcasting			
☐	Methods for predicting the future primarily include forecasting and backcasting.	36	87.8
☐	Backcasting involves envisioning the desired future first, then reverse-engineering from future goals and dreams to devise measures that should be taken in the present or near future.	40	97.6
☐	Forecasting entails accumulating and analyzing past data, understanding past trends from the analysis results, and predicting the future based on the current realized state.	40	97.6
GW Exercise (2) : SDGs/CE-VCM			
☒	Value Chain Management includes Supply Chain Management, which involves managing component suppliers.	32	78
☒	Value Chain Management includes Stakeholder Management, which involves managing platform stakeholders.	29	70.7
GW Exercise (3): SDGs/CE Product Planning			
☒	The theme name for SDGs/CE product planning refers to Corporate Branding.	34	82.9

GW Exercise (4): Sharing Platform			
×	MSP stands for Multi-Side Panel, representing a type of business process model.	38	92.7
○	Application software is designed, produced, and distributed by the side performing platform services.	37	90.2

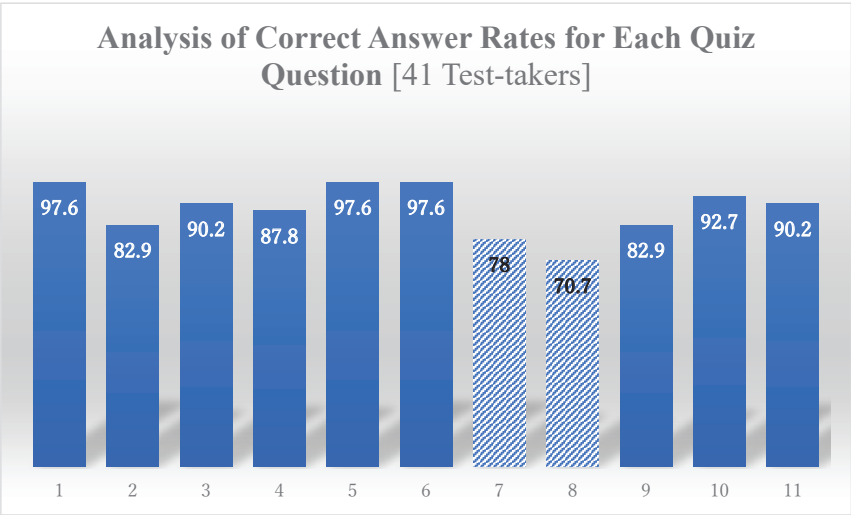


Figure 4.1 Analysis Results of Correct Answer Rates for Each Quiz Question on the "SDGs/CE Business Concept Proposal" [41 Test-takers]

4.2Analysis and Discussion of Questionnaire Survey Results on "SDGs/CE Business Concept Proposal"

After the completion of the group work exercises on the "SDGs/CE Business Concept Proposal," a questionnaire survey was conducted, and the analysis results were presented in **Table 4.2** and **Figure 4.2** (with 32 valid responses).

Table 4.2 Questionnaire Survey Results on the Implementation of Group Work Exercises for the "SDGs/CE Business Concept Proposal" [32 Valid Responses]

		Response Rate (%) for 32 Valid Responses				
[1: Strongly disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly agree] ➡		1	2	3	4	5
Questions Regarding Learning Motivation for SDGs/CE and "Group Work Exercises" with assigned Roles						
1	After the group work exercises, compared to before course registration, did <u>your motivation for learning deepen</u> even further regarding the course's learning objective of devising business proposals for solving societal issues related to the "SDGs"?	0	3.1	15.6	68.8	12.5
2	After the group work exercises, compared to before course registration, did <u>your motivation for learning deepen</u> even further regarding the course's learning objective of devising business proposals for solving societal issues related to the "CE"?	0	0	15.5	62.5	21.9
3	Do you think the class format of "group work exercises" with assigned roles for creating the "SDGs/CE Business Scheme Proposal" as the final course goal was appropriate?	9	3.1	9.4	65.6	21.9
Questions regarding Group Work Exercise (1): Backcasting Technique						
4	Was it possible to effectively utilize the "Backcasting Technique" when the entire team determined the theme for <u>the 2025 fiscal year for projects related to SDGs/CE social issue resolution?</u>	0	3.1	12.5	59.4	25
5	When setting the theme for projects related to SDGs/CE social issue resolution, were you able <u>to understand the necessity and significance</u> of the "Backcasting Technique" compared to the traditional "Forecasting Technique"?	0	0	9.4	59.4	31.3
Questions regarding Group Work Exercise (2): SDGs/CE Value Chain Management (VCM)						
6	When planning new businesses and developing new products to address SDGs/CE social issues, existing business processes and distribution channels cannot be utilized. Could you understand <u>the necessity and significance of deliberately creating a new "SDGs/CE-VCM"?</u>	0	0	3.1	84.4	12.5

Questions regarding Group Work Exercise (3): SDGs/CE Product Planning						
7	Did the theme of "SDGs/CE product planning" decided by your team <u>correspond to the expectations for solving social issues through SDGs/CE</u> ? At the same time, did you think that your team was able to create a <u>SDGs/CE product plan</u> that would be an <u>attractive proposition to your target customers</u> ?	0	3.1	21.9	50	25
Questions regarding Group Work Exercise (4): Multi-sided sharing platform (MSP)						
8	After associating the aforementioned "SDGs/CE-VCM" with "stakeholders," did you think your team was able to successfully establish a balance between setting new project themes for "MSP" and "application software" aligned with each pair of stakeholders?	3.1	0	28.1	50	18.8

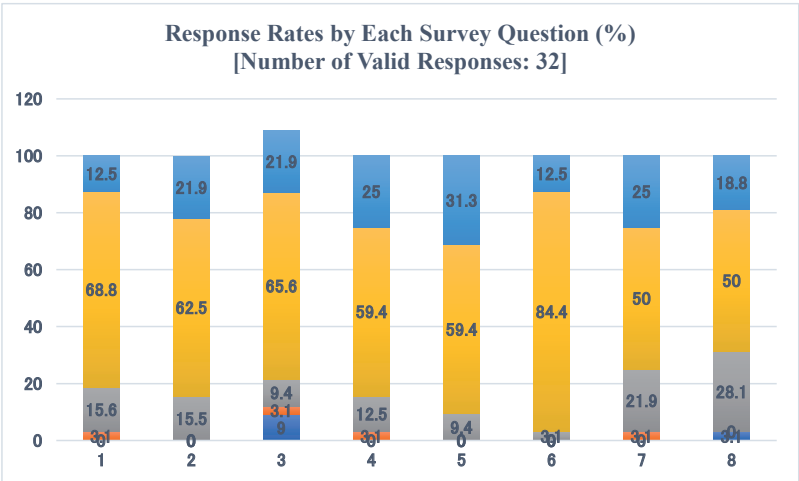


Figure 4.2 Response Rate (%) Corresponding to five Levels for Each Survey Question [32 Valid Responses]

Regarding the first question about the improvement of **motivation to learn SDGs/CE**, and the class format dividing **different role allocation**, examining the analysis results

presented in **Table 4.2** and **Figure 4.2**, it is evident that motivation improved as each team was able to choose a project theme for solving social issues related to SDGs/CE. Additionally, the learning format, which introduced four types of business task allocation for group work exercises, was approved by learners.

From the free-form responses in the survey, it was confirmed that during the process of determining the theme for solving SDGs/CE social issues, the entire team worked collaboratively, and a strong consensus was achieved through the exchange of opinions among team members. Many learners stated that this process facilitated a solid shared awareness during group work exercises.

Regarding Group Work Exercise (1): **Backcasting Technique**, many learners said that this technique was effective in overcoming the difficulty of generating ideas when finding themes for future social issue resolution. Furthermore, it was observed that learners understood the necessity and significance of the backcasting technique in comparison to traditional forecasting techniques used to predict the future.

Regarding Group Work Exercise (2): **SDGs/CE Value Chain Management (VCM) Techniques**, many learners acknowledged that when planning new businesses or new product proposals to address the social issues of SDGs/CE, existing business processes and distribution channels may not be applicable. As a new strategy for this purpose, the team members understood that they themselves needed to create the new SDGs/CE-VCM that matched the SDGs/CE theme for resolving the social issues mentioned above.

Regarding Group Work Exercise (3): **SDGs/CE Product Planning Technique**, 75% of learners who answered indicated that their team's chosen "SDGs/CE product proposal" theme was able to balance economic and social value. Simultaneously, many learners responded that they could set an attractive SDGs/CE product proposal theme for the future target customers.

From these results, the research significance of the group work exercise on product planning lies in the learners' ability to recognize the gap between real-world problems and future challenges. They expressed the motivation to create appealing product plans for future target customers while addressing the issues to be resolved in the context of SDGs and CE.

Regarding Group Work Exercise (4): **Multi-Side Sharing Platform (MSP)**, nearly 70% of learners responded that they were able to set a new theme for "MSP" in correspondence with the aforementioned "SDGs/CE-VCM" and "stakeholders". Simultaneously, they reported success in setting new "application software" for each pair of MSP stakeholders.

The significance of this MSP group work exercise lies in the fact that, compared to the learning content of the previously mentioned exercises, it primarily introduced specialized knowledge of MSP and application software to business students, most of whom were encountering these concepts for the first time. The alignment of this specialized knowledge with the new proposals of "SDGs/CE-VCM" and "stakeholders" by the autonomous teams was particularly challenging, given the advanced skills required. Despite this difficulty in the context described above, the exercise proved meaningful by demonstrating that nearly 70% of learners were able to enhance

their self-efficacy through the exercise.

4.3 Analysis of Evaluation Results for Team-Based Deliverable Worksheets on "SDGs/CE Project Concept Proposal"

The "SDGs/CE Project Concept Proposal" presented in Section 4.3 was composed of four types of group work exercises. To assess the submitted deliverable WS for each team and provide feedback, the following evaluation criteria for the WS were established.

【Evaluation Criteria for SDGs/CE Project Concept Proposal Deliverable WS, out of 40 points】

Group Work Exercise (1): Backcasting WS [10 points]

1.1 "SDGs/CE Social Issue Resolution Theme"

1.1.1 Specificity of era, vision, values, situation, and background

1.1.2 Consistency with the backcasting process

1.2 Concrete description of the target period in the 2020s for theme setting

1.2.1 Era of the 2020s

1.2.2 Vision

1.2.3 Values

1.2.4 Situation and background

Group Work Exercise (2): SDGs/CE-VCM/ Application Software (AP) WS [10 points]

2.1 Concrete expression and explanation of the "SDGs/CE Social Issue Resolution Theme"

2.2 Composition of the entire Supply Chain Management (SCM)

2.2.1 Consistency in the flow of goods

- 2.2.2 Appropriateness of content description
- 2.3 Stakeholder management
 - 2.3.1 Identification of "Stakeholders (Partners)"
 - 2.3.2 Appropriateness of describing activities for each stakeholder
- 2.4 Collaborative activities linking stakeholders
- 2.5 Proposal of application software: Application linking two paired stakeholders

Group Work Exercise (3): SDGs/CE Product Planning WS [10 points]

- 3.1 Product brand
- 3.2 Product image diagram
- 3.3 Key points for target customers
- 3.4 Manufacturing and sales timing and methods
- 3.5 Key points for package design

Group Work Exercise (4): Overall Image of MPS WS [10 points]

- 4.1 Description of supply chain (logistics)
- 4.2 Description of information flow
- 4.3 Appropriate names for applications
- 4.4 Appropriate names for the sharing platform

Based on the evaluation criteria, the results of grading the **deliverable WS** submitted by 10 teams are presented in **Table 4.3** and **Figure 4.3**. Among the teams, only five achieved a high score ratio of 80% or more out of the 40 points. While Exercise (2) alone scored in the six-point range (each exercise is out of 10 points), most teams (excluding Team 9) scored in the seven-point range for the other exercises, indicating that they had met

the pass criteria for the "SDGs/CE Project Concept Proposal" exercises.

Table 4.3 Analysis of Grading Results for Team-Specific Deliverable Workshop on "SDGs/CE Project Concept Proposal" (61 learners, 10 teams, Deliverable WS out of 40 points)

Team number [Number of members]	1 [5]	2 [6]	3 [6]	4 [5]	5 [6]	6 [5]	7 [5]	8 [4]	7 [5]	8 [4]	9 [6]	10 [4]	Average score	Standard deviation
Exercise theme [10 points for each exercise]														
GW Exercise (1): Backcasting	8	8	0	6	7	9	9	9	6	8	10	9	7.4	2.6
GW Exercise (2): SDGs/CE-VCM/AP	4	8	6	6	7	6	7	9	0	7	9	4	6.1	2.4
GW Exercise (3): SDGs/CE Product Planning	10	9	7	8	6	7	6	9	0	9	10	8	7.4	2.6
GW Exercise (4): MSP	1	10	7	7	7	9	10	10	5	8	5	5	7	2.6
Total score by team [Full score 40]	23	35	20	27	27	31	32	37	11	32	34	26	27.9	7.4
Total score ratio by team (%) [Full score 40]	57.5	87.5	50	67.5	67.5	77.5	80	92.5	27.5	80	85	65	69.75	

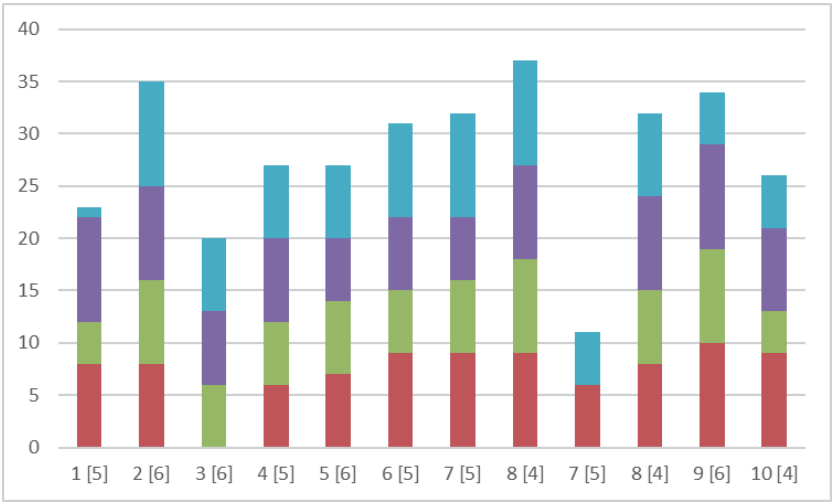


Figure 4.3 Scoring results by team for “SDGs/CE business concept” deliverable WS

(The four-level numbers on the bar graph indicate the team score/10 points for the four exercises, and from the bottom, the scores for exercises 1, 2, 3, and 4, totaling 40 points.)

It should be noted that the **"SDGs/CE Project Concept Proposal"** was the first exercise task undertaken by the entire team during the course. TAs provided feedback based on the evaluation criteria for the **deliverable WS** submitted by each team. Following this, the instructors pointed out that considering that this "SDGs/CE Project Concept Proposal" is partially included in the final deliverable, the "SDGs/CE Business Concept Proposal," improvements should be made according to the revision comments. It was emphasized that by continuing such learning efforts, there is an opportunity to enhance the overall team performance.

The following **summarizes learners' feedback** from a free-form section in a post-submission survey for the "SDGs/CE Project Concept Proposal." Additionally, opinions were sought from learners regarding improvements to the progress of this exercise.

The following is a summary of individual learners' impressions in free-form responses from the survey after each team completed the submission of the deliverable WS for the first "SDGs/CE Project Concept Proposal" group work exercise. These following three categorized insights underscore the richness of perspectives stemming from diverse backgrounds and experiences within the context of group work.

Category 1: Positive Feedback

1. Teamwork and Diversity of Ideas

- The collaborative nature of group work has facilitated the emergence of ideas beyond individual capacities, fostering a broadened scope through interactions with diverse individuals.

- Effective discussions within the group, aimed at maintaining a cohesive approach, have successfully addressed challenging problems.

2. Integration of Learning and Enjoyment

- Collaborative discussions have not only been enjoyable but also enriching in terms of learning.
- Topics envisioning the future have sparked interest, with the consensus that group collaboration yields better results than individual contributions.

3. Utility of Backcasting

- The application of backcasting techniques has proven useful in setting realistic goals and stimulating creative idea generation.
- The equitable exchange of opinions within the group, coupled with the utilization of backcasting, has resulted in a cohesive and enjoyable collaborative process.

Category 2: Areas for Improvement

1. Time Constraints and Improved Understanding

- Initiating discussions sometimes takes longer due to the necessity for a baseline understanding among all members.
- Clearer explanations are desired to expedite the initiation process.

2. Specific Feedback and Information Access

- Participants express the need for more specific feedback and improved access to the latest information on SDGs.
- Enhancements in information access methods are sought for more effective collaboration.

Category 3: Divergent Opinions

1. Leadership and Thematic Choices

- Varied evaluations of leadership effectiveness exist, with differences in opinions on the effectiveness of the provided leadership.
- Divergent opinions on thematic choices indicate varying perspectives within the group.

2. Progression of Group Work

- While some perceive the progression of group work as smooth, others express concerns about the time taken to confirm understanding levels at the outset.
- Differing opinions on the efficiency of the initiation process highlight varying perspectives within the group.

5. Conclusion

Section 2.3 addressed the benefits of modifying the overall class design from “Parallel” to “Serial” for group work exercises. First, the impact of the transition to "**Serial Course Design**" and the corresponding measures was described as follows:

- To address the challenges posed by the shorten lecture times, the "**Digital BOOK**" was used to facilitate efficient and effective collaborative learning during group work exercises.
- Additionally, the use of a digital whiteboard, specifically "Google Drive," allowed multiple team/group members to simultaneously create deliverable WS in an online environment, allowing collaboration during group work exercises and enabling the efficient and effective progress of group work exercises.

Chapter 3 explored the basic specifications of Digital Books for utilization during group work exercises and their application to "**SDGs/CE Business Concept Proposal**" as a case study. The "**Digital Books**" educational resources encompass the following features:

- Lecture presentation materials.
- Explanatory text accompanying the materials; explanations of keywords/specialized terms such as the "Specialized Term Wiki System."
- Machine-generated audio corresponding to the explanatory text.
- External links from the "Digital Book" to the Learning Management System using "QR codes" and to the web using "Linked URLs."
- Utilization of "QR codes" for LMS, enabling the download of worksheet materials during group work exercises, as well as the implementation of a "Quiz" and "Surveys for Course Evaluation."
- On the LMS side, the storage of individual learner's response data.

Chapter 4 introduced verification and analysis of the effectiveness of the "**SDGs/CE Business Concept Proposal**" group work exercise (based on test score results, questionnaire survey analysis, and evaluation of team-specific worksheet outcomes).

Regarding analysis of **Quiz Results**, it could be inferred that the understanding of specialized knowledge related to the "**SDGs/CE Business Concept Proposal**" generally met the educational objectives.

Regarding analysis of **Questionnaire Survey Results**, it is evident that motivation improved as each team was able to choose a project theme for resolving social issues related to SDGs/CE. Additionally, the learning format, which introduced four types of business task allocations for group work exercises, was approved by learners.

Regarding the evaluation results for **team-based deliverable WS** on "SDGs/CE Project Concept Proposal", based on the predetermined evaluation criteria, the results of grading the deliverable WS submitted by 10 teams were presented in Table 4.3 and Figure 4.3. Most of the teams were able to meet the pass criteria for the "SDGs/CE Project Concept Proposal" even though it was the first group work exercise.

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