1. INTRODUCTION

Although business administration has emphasized the importance of a company’s mission, vision, and values, entrepreneurship education has pointed out that self-awareness is outside the scope of cognitive psychology and therefore outside the area of expertise, and that there is little related research because entrepreneurial intention is regarded as a given condition for aspiring entrepreneurs.

According to Kanama [1], entrepreneurial motivation is the most under-researched area. The reason for this is that this area covers a wide range of academic disciplines such as psychology, management, and education. The reason for this is that this field covers a wide range of academic disciplines such as psychology, business administration, and education, which makes it difficult for research results to be translated. This is because this field covers a wide range of academic disciplines, including psychology, business administration, and education.

In business administration, Sarasvathy’s effectuation thinking model has been attracting attention as a thinking characteristic of entrepreneurs engaged in new business development. Effectuation is a thinking model in which the entrepreneur makes the best use of the resources at hand, executes first, and then understands the order of the determinants. The opposite of effectuation is coding, which is a model of thinking in which the order of the determinants is understood first and then executed. Effectuation is a way of thinking about the physical and physical activities in the process of building a new business. It is a very practical and effective approach to bring a business model closer to completion by making full use of existing knowledge and skills, acting first, and repeating fine adjustments.

This paper proposes a rubric for specific activity procedures regarding the exposure of unconscious “mental energy,” focusing on “self,” one of the three means of efficacy. The rubric defines the process of utilizing images and symbols as a means of unconscious exploration, based on a series of Affective values incorporating Affective engineering perspective of self-awareness, intersubjectivity, and meaning sharing, to realize temporary self-awareness for university students.

2. THEORIES RELATED TO EFFECTUAL ENTREPRENEURSHIP

2.1 Effectual Entrepreneurship

According to Sarasvathy [2], effectuation is a way of thinking in which one makes full use of what one has, and there are three means that anyone can use: oneself, one’s knowledge, and one’s acquaintances. The author developed a self-awareness workshop as a means of maximizing the use of “oneself” in the effectuation mode of thinking, and verified its effectiveness (Paper submitted to [3-5]).

Today, in entrepreneurship education at universities in Japan, priority is given to knowledge and skills education, and entrepreneurship is neglected. When thinking about
fostering entrepreneurship, I thought it was necessary to understand the subjectivity, sensitivity, and values within the “ego” of entrepreneurs. I also thought that the findings of depth psychology would be useful in examining the ego.

In response to the question of what is the “I” and what is the “ego,” Western psychology defines the “ego” as the subject of human action and consciousness. The ego perceives the external world through the senses, such as sight and hearing. At the same time, the ego cognizes the inner world. Cognition of the inner world means recognizing one’s own desires and feelings. It is understood that the ego makes decisions proactively based on its perception of the external world and its perception of the internal world. Jungian psychology showed that a person’s consciousness is influenced by the actions of the unconscious, and it is characteristic of depth psychology to divide the human mind into hierarchical structures such as the conscious and the unconscious. With regard to the unconscious, Jung divides it into the personal unconscious, which is related to the individual’s life, and the universal unconscious, which is common to all human beings.

Kawai [6] says that the layer of personal unconscious consists of the contents of sensory traces left in the mind, as if they were once conscious but faded into memory with the passage of time. In general, it is said that entrepreneurs consume an enormous amount of effort, or physical energy, when they start a business. The consumption of energy means that when physical work is done, a corresponding amount of energy is consumed. There is no doubt that entrepreneurial activity requires some physical activity, and that physical energy is consumed by that activity. On the other hand, when humans perform physical work, mental work must also be done at the same time, and when mental work is done, mental energy must be consumed. Kawai says that it is easier to understand the problem of human consciousness and unconsciousness by introducing Jung’s concept of “mental energy”. It is said that physical and bodily energy in human activities can be measured quantitatively. In Jung’s depth psychology, the source of mental energy is the ego’s consciousness and unconsciousness.

2.2 Utilizing Affective engineering for Self-awareness

Self-awareness is a source of emotional value for human beings. Self-awareness is the source of emotional value for human beings because it contains subjectivity, sensitivity, and values. Self-awareness is the source of value that cannot be imitated by others, that is, the source of value that prevents products and services from becoming obsolete through commoditization. However, in entrepreneurship education at universities, there is an important challenge in helping university students understand their own values.

The question is, do university students have a sense of self-worth? If they cannot recognize their own values, they will not be able to trace the source of their own emotional values. Some people believe that the concept of effectuation entrepreneurship can be applied to entrepreneurship education in universities, but it is working people who can utilize the three existing resources of “myself,” “my knowledge,” and “my acquaintances,” while university students lack all three.

In particular, the understanding of “self” tends to be overlooked in entrepreneurship education. A clue to solving the important issue of lack of self-understanding for university students is affective engineering view of values. Shiizuka [7] defines Affection (Kansei) as “Affection is a function of perception and works as a system.” As Figure 1 shows, if perception as an independent variable is \(s\) (input) and expression as a dependent variable is \(e\) (output), it is expressed as \(e = f(s)\). “f” is a function that maps perception to expression, and this \(f\) varies from person to person, and this is defined as Affection (Kansei).

As Figure 2 shows, if sensibility is viewed from the perspective of systems thinking, an individual has one’s sensibility \((f)\) at the present time, regardless of the length of one’s life or the richness of one’s life experience. Therefore, self-awareness should be possible even for university students.
In general, it is said that “people’s sense of value changes with the passage of time,” but from the Affective Engineering perspective, Affection ($f$), which is a function of perception, also changes over time. From the viewpoint of Affective Engineering, Affection ($f$), which is a function of perception, also changes over time. Therefore, the content of “what I like now,” which is expressed as a dependent variable ($e$), also changes. In other words, if sensitivity ($f$) varies from person to person and changes over time, then the answer to the question “What do I like now?” can be said to be a sensible value as a “Snapshot of consciousness”.

In this study, the author propose the rubric that follows the approach of identifying and extracting “temporary” sense of values at that point and recognizing deepening sense-making among project team members.

3. ENHANCING SENSEMAKING FOR PBL

3.1 From mental activity to physical activity

Figure 3 shows a diagrammatic representation of PBL activation based on the SECI model, which changes the physical activity (PBL activity) from the mental activity (self-awareness). The first step is to recognize one’s own sensible values (communalization). The next step is to foster intersubjectivity with team members. At this time, it is necessary to prepare a “place” for fostering intersubjectivity, so we prepare work to learn the values of the team members and find out what they have in common. The next step is to create a team vision statement as an outcome of intersubjectivity.

At this stage, common set of values for the team project is formed among the team members, and a shared sense of meaning for the subsequent PBL activities is created (emergence). This shared sense of meaning for the PBL activity is sense-making, and the process of “Socialization” and “Externalization” in the SECI model is mental activity, or sense-making, which fosters motivation for the physical activity of the PBL activities. In the process of continuing the PBL activities, the team members will further develop a sense of the meaning of the PBL activities.

4. SENSEMAKING PROCESS

Table 1 shows the process of sense-making among team members in a PBL activity. The VIA Model based sense-making process is a process to achieve sense-making in a simplified way by utilizing the VIA Model in an environment where participants of entrepreneurship education program do not have sufficient conditions to reach sense-making. The VIA Model based sense-making process corresponds to the SECI model, phenomenology, and various concepts of sense-making. In Weike’s sense-making theory [8], it is presented in the ESR model, a process of “ecological change, enactment, selection, and retention”.

The purpose of the ESR model is to explain the process of organizing based on Darwin’s theory of evolution. Although the organizational unit in PBL activities is a project team consisting of three to five members, the subjectivity of each participant who is a team member is polysemic.

Weike defined organizing as “a grammar” that everyone thinks is reasonable in order to reduce polysem from conscious interconnected behavior. In other words, organizing is the production of agreed-upon validity. This “agreed-upon validity” refers to sense-making. As shown in Table 1, I presented an organizing course model that consists of four elements as an action process: ecological change - enactment - selection - retention.

| Table 1: The VIA Model based Sensemaking Process |
|-----------------|-----------------|-----------------|-----------------|
| Sensemaking     | Personal behavior | Interrelationship behavior | Collective behavior |
| Process         |                  |                  |                  |
| Actor           | One person called | Two-person term | Three-person term |
| Phenomenology   | Introspectivity  | Inter-subjectivity | Subjectivity    |
| Subject – Object| Subject          | Object           |                  |
| SECI Model      | Internalization  | Socialization    | Externalization |
| VIA Model       | Values           | Intentions       | Action          |
| ESR Model       | Enactment        | Selection        | Retention       |
| Diversity of values and visions | Much | Less |
| Deliverables   | Personal vision statement | Team vision statement | Meaningful project activities |
Enactment corresponds to “mutation” in the natural selection model, and according to Wike, enactment includes actions such as saying, doing, casting a web of meaning, adapting, and creating mutations.

Furthermore, what the organizing model implies is that action defines cognition. In other words, in the process of a team’s project activities, Enactment progresses gradually. In PBL activities, Enactment is not the completion of mutation, but a process of mutation, in which interaction occurs between the subject (team members) and the object (project environment). The activation in PBL activities is not a “completion of mutation” but a “mutating process,” interpreted as a situation in which interaction occurs between the subject (team members) and the object (project environment).

Then, in the process of enactment, we ask what kind of meaning the current action (PBL activity) has, and each team member makes meaning as they think more deeply about it. In other words, although the purpose and goal of the project activities are initially interpreted in multiple senses within the team, the multiple senses are gradually reduced through discussions among team members. Enactment is a process of creating materials that can be made meaningful. In addition, enactment is in line with the process from collaboration to representation in the SECI model. The activation in PBL activities is interpreted as a situation in which interaction occurs between the subject (team members) and the object (project environment). The process of creating a business plan that each team works on in a team project format is in line with the organizing process described by Wike. Usually, teachers organize the teams for the project, but rarely with special intentions or regularity, and in many cases, the teams are randomly divided. The values of the members in a randomly organized team should be diverse, and it is natural that each member has different sensibilities and values. Then, through team project activities, they can understand each other’s different values and understand each other’s personalities, and the artifact of the enactment is the clarification of the team vision statement.

In other words, the team vision statement is like the raw material for the business plan that will be given meaning in the later stages of the project. An enacted team vision statement inherently reduces the polysemy of the team members and positively influences the creation of the business plan, which is equivalent to subsequent selection.

Retention also means that at the end of the project activity, the business plan is complete. It is at this point that the meaning-making of the project activities as a team is generated. Meaning making is done near the end of the project activity and after the end of the project activity, so it becomes retrospective and at the same time, there is feedback for selection and enactment. Instead of being 100% satisfied with the team’s activities so far, we feel satisfied that we have completed the project, but at the same time, we feel regret that we could have done this part better, or that we should have done that part better. Looking back on the past activities, we feel satisfied, but we also feel remorse. When team members share this ambivalent situation where conviction and reflection coexist, polysemy is further reduced and sense-making progresses.

5. RUBRIC FOR SENSEMAKING IN PBL

5.1 ICE Rubric for enhancing Sensemaking

Regarding team formation in organizations, the Tuckman model and Kim’s success cycle model are well known in management science. The former explains that team formation gradually deepens over time, while the latter states that the quality of the relationship affects the quality of thinking, behavior, and results. In this paper, we created a rubric for self-evaluation by university students of the activity process of sensemaking in entrepreneurship education. A rubric is defined as “a method of creating standards for evaluating learning, consisting of a ‘scale’ that is an evaluation level and a ‘description of characteristics’ when the scale is met” (Central Council for Education, 2012, “Glossary”).

Particularly in the series of work from self-awareness to sensemaking, it is possible that university students’ level of understanding and execution may want to reach the stage intended by the lecturer. Therefore, it is necessary to define the conceptual understanding and expected outcomes in advance, and have university students self-evaluate after the work is done.

In this study, the author developed a qualitative ICE rubric, where ICE stands for Ideas, Connections, and Extensions. ICE is a concept of course design for faculty developed by Young [9]. ICE is a learning method and ICE rubric is an assessment method. ICE rubric has the advantage of making learning and assessment “visible” because learning method and assessment are integrated.

The purpose of this ICE rubric is for students themselves to qualitatively self-evaluate their understanding and
achievement of each item regarding the activity process of the VIA model. In addition, the level of understanding of each item should gradually and qualitatively change before, during, and after the start of the PBL activity through intersubjectivity and sharing of meaning with team members. Therefore, we expect that the reflections using the ICE rubric will contribute to the deepening sensemaking among team members. The evaluation of ordinary rubrics is a “level evaluation,” and the levels can only be distinguished by vague expressions such as “can do,” “can do a little,” and “can hardly do” in the evaluation description. The ICE rubric, on the other hand, allows for specific evaluation in the areas of I, C, and E. General rubrics are effective tools if the teacher’s purpose is to grade students, but if the teacher wants to instruct appropriately according to the learners’ learning, ICE rubrics are useful. This is because the ICE rubric can clarify where and how learners stumbled and why in each area.

The author utilized the above ICE rubric in entrepreneurship education program at Kumamoto university. Participating students were briefed in advance on the SECI model, Self-awareness, and the purpose of creating team vision statement before participating in the work. Table 2 shows the results of the self-assessment based on the ICE rubric just before and two and a half months after the start of PBL performed by the seventeen university students in Kumamoto University. The results showed that the understanding of self-awareness and sensemaking deepened in each evaluation item before and during the PBL. In particular, 94% of the participants’ understanding of their own values and those of their team members improved. Also, regarding the team vision statement, 69% of the respondents reported that there had been a content update since the beginning, and 44% reported that they had reached Level 3 during the project. The percentage of PBL participants who improved their understanding of the SECI model from Level 1 to Level 3 and the percentage of students who improved their understanding of self-awareness from Level 1 to Level 3 were both 47%. The percentage of respondents who improved their understanding of the SECI model from Level 1 to Level 3 and the percentage of respondents who improved their understanding of self-awareness from Level 1 to Level 3 were both 47%. In addition, the percentage of respondents who improved from Level 1 to Level 3 in terms of their understanding of value word selection was 53%.

### 5.2 Results of self-assessment by PBL participants

The author utilized the above ICE rubric in entrepreneurship education program at Kumamoto university. Participating students were briefed in advance on the SECI model, Self-awareness, and the purpose of creating team vision statement before participating in the work. As Figure 4 shows, we had the self-assessment two times: At the middle of PBL and After completion of PBL. Table 3 shows the results of the first self-assessment based on the ICE rubric just before and two and a half months after the start of PBL performed by the seventeen university students in Kumamoto University. The results showed that the understanding of self-awareness and sense-making deepened in each evaluation item before and during the PBL.

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**Table 2: ICE Rubric for enhancing Sensemaking in PBL**

| Evaluation Items                                    | Level 1                                                                 | Level 2                                                                 | Level 3                                                                 |
|-----------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Understanding of SECI model                        | Understand an overview of SECI model                                    | Understand SECI model as it applies to PBL activities                   | Understand the cycle of SECI model in PBL activities                    |
| Understanding of “Socialization”                   | Understanding the meaning of “Socialization”                            | Realize through the experience of “Socialization”                       | Realize more through PBL activities                                     |
| Understanding of Self-awareness                    | Understanding the importance of Sense of values                         | Understand the changing sense of values of self                         | Understand universal sense of values                                     |
| Understanding of value words of self               | I just marked the value words that Intuitively ring a bell              | Consider the meaning of the relevance of the selected value words       | Convince yourself to think about the implications of the value words you choose |
| Understanding of value statement development       | Imagine what the selected value words remind you of                     | Explore value statement consistency while trying to connect the value words | Revise value statement to make it more convincing                        |
| Understand and respect other’s sense of values     | I was able to get a vague impression of another person’s personality    | I have some understanding of member’s personality                       | Understand members’ personalities and collaborate with them rather well   |
| Create the team vision statement                   | Write down what each person has in common while interacting with each other | Write down the common elements of each person and connect them to form one sentence | Based on the tentative statement, make sure everyone agrees on the vision statement |

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![Figure 4: Scope of self-assessment by PBL participants](image-url)
In particular, 94% of the participants’ understanding of their own values and those of their team members improved. Also, regarding the team vision statement, 69% of the respondents reported that there had been a content update since the beginning, and 44% reported that they had reached Level 3 during the project.

The PBL was conducted over a period of five months, with three hours each week as a class. Also, all project team members interacted online because of the Covid-19 disaster. Table 4 shows the results of the second self-assessment in PBL during the PBL period (two and a half months later from the start) and immediately after the completion of PBL (five months later from the start). The percentage of improvement in the level of understanding for each assessment item was high, ranging from 69% to 92%.

The percentage of improvement in understanding of each item was high, ranging from 69% to 92%. The percentage of improvement in understanding was 85% and 77% for the items “Convincingness of value word selection” and “Convincingness of one’s own value statement. For both items, 46% and 77% of the participants self-assessed their improvement from Level 1 to Level 2, respectively.

These results indicate that PBL has deepened their self-understanding. In addition, 92% of the participants improved their understanding of their team members, and 54% of them answered that they improved from Level 1 to Level 3, indicating that their understanding of others advanced in the latter half of the PBL. Regarding the team vision statement, 69% of the respondents indicated that the update regarding the content of the statement progressed in the second half of the PBL, and 31% of the respondents reached Level 3.

From the above, the university students participating in the PBL self-evaluated that their self-understanding and understanding of other companies had improved in the course of the project activities compared to just before the start of the PBL. In other words, through the team project, inaction progressed, and the team vision statement created at the beginning of the activity was rewritten into a text that they could understand independently without any instruction from the instructor, through the process from intersubjectivity to intersubjectivity. This indicates that polysemy was gradually reduced as the project activities progressed.

### 6. CO-OCCURRENCE NETWORK

In order to analyze the relationship between words in the text data written on the questionnaires collected after the PBL activity, we used KH Coder, an open sources software for text mining, and analyzed the co-occurrence relationship using the co-occurrence network, which connects strongly connected words with straight lines and represents them visually. We analyzed co-occurrence relationships using co-occurrence networks. In the co-occurrence network, we applied the Jaccard coefficient as a measure of the strength of the co-occurrence relationship, which is a numerical value that expresses the co-occurrence relationship probabilistically.

The questions for the questionnaires in 2019 and 2020 were all the same. Figure 5 shows the co-occurrence network created from the text data of the questionnaires obtained from the five teams of undergraduate students in 2019. These five teams participated in Self-awareness workshop, but they did not do the work of creating team vision statement and started the project activities.

![Table 3: Results of the first self-assessment (two and a half months after the start of PBL) on gaining deeper understanding of self-awareness and sense-making](image1)

![Table 4: Results of the second self-assessment (five months after the start of PBL) on gaining deeper understanding of self-awareness and sense-making](image2)
Therefore, the VIA model is not being utilized for them. In this co-occurrence network, there is no straight line showing the co-occurrence relationship between each cluster.

Although the word “team” was present, there were no words that indicated a relationship with team members or a relationship with self-awareness, and there was no particular element that indicated the effectiveness of cooperative learning. Figure 6 shows the co-occurrence network created based on the text data of the questionnaires of three teams with the eight graduate students.

Figure 6 shows the co-occurrence network of a graduate student team that utilized the VIA model in the Entrepreneurship Education Program in 2020. It shows a glimpse of how the team members recognized the difficulty of communication among them, and then formed a consensus through repeated dialogue to create a business plan. In addition, although not directly related to the co-occurrence network, it is characteristic of the Covid-19 disaster that, compared to previous years, the team realized the importance of connecting with society and taking actions, such as conducting interviews for market research directly in the real world. Also, Figure 7 shows the co-occuring network of undergraduate student teams utilizing the VIA model in the Entrepreneurship Education Program in 2020. The connections between the clusters are clear (self - member - learn - project - think).

As shown in those three co-occurrence networks, the difference between the case where the VIA model is not utilized and the case where the VIA model is utilized has become clear.

7. CONCLUSIONS

In this study, we developed the ICE rubric to check the degree of achievement of the methodology of understanding sense of values based on affective engineering and realizing sensemaking among team members. On the other hand, the ICE rubric made it easier for the instructors to determine their teaching policies.

However, three challenges were identified: first, it is not possible to determine whether self-awareness has a positive impact on the quality of the business plan.

According to Sarasvathy, one’s self is a collection of temperaments, abilities, and characteristics, and understanding one’s temperament and characteristics alone is not enough to fulfill the requirements for a business plan.
to be realized and successful. It is necessary to develop the capabilities to put a business into action. The second is that the rubric standardizes behavior and thinking to some extent, and although PBL expects university students to take initiative, it is problematic that the process of trial and error in developing their own methodology is neglected when the rubric presents the level of achievement in advance. Third, because the rubric was introduced on a trial basis when the common rubric for the entire entrepreneurship education program had not been completed, consistency in the program was not ensured. Since the rubric has the function of smoothly conveying the intentions of the faculty, the criteria presented in it is to influence the basis of students’ thinking and judgment criteria. Therefore, it is thought that there is a possibility that students’ thinking may be standardized by the criteria indicated by the faculty member.

In entrepreneurship education, rubrics for PBL activities are useful, but we should recognize the need to adjust them while taking into accounts the need to ensure consistency with the common rubric for the entire education program.

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