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The Implementation and Systematic Reconstruction of the I-E-O-L Model for Streamlining and Advancing Student Surveys

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Abstract

This study proposes the I-E-O-L model, an extension of Astin's Input-Environment-Output (I-E-O) model, as a comprehensive framework for managing student surveys. The I-E-O-L model introduces the "Life Career (L)" component to incorporate postgraduation data, enabling a holistic evaluation of student growth and long-term educational impacts. This model aligns with the Ministry of Education, Culture, Sports, Science and Technology's (MEXT) Guidelines for Academic Management, emphasizing its relevance to higher education policy in Japan. Three case studies illustrate the utility of the model: 1) visualizing survey implementation promotes shared understanding and collaboration among stakeholders, 2) aligning survey frameworks with MEXT guidelines enhances institutional research (IR) activities, and 3) systematic reviews and "inventorying" of fragmented surveys reduce redundancy and improve survey reliability and validity. These practices collectively streamline survey operations, reduce respondent fatigue, and enable data-driven educational improvements. While the I-E-O-L model shows significant potential for application across diverse educational contexts, its adaptability extends beyond Japan, as supported by international research and practice. By leveraging this model, institutions can enhance survey efficiency, obtain deeper insights into student outcomes, and foster educational quality. These findings highlight the model's effectiveness in improving survey-based decision-making in higher education.

Keywords: I-E-O-L Model, Institutional Research, Student Survey Management, Inventorying Student Surveys, Consensus Building.

1 Introduction

In Japan, universities are increasingly required to evaluate and improve educational outcomes to foster learner autonomy and strengthen institutional operations, as outlined in the Ministry of

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Education, Culture, Sports, Science and Technology (MEXT) Guidelines for Academic Management (hereafter referred to as "the Guidelines") [1][2]. These Guidelines emphasize the importance of establishing a robust Institutional Research (IR) system related to education to systematically collect, analyze, and utilize data to improve teaching and learning. One of the primary tools for this purpose is student surveys, which play a crucial role in understanding student growth, learning environments, and postgraduation outcomes.

The widely recognized Input-Environment-Output (I-E-O) model proposed by Astin serves as a fundamental framework for evaluating academic outcomes [3][4]. It emphasizes three key components: Input (I) (students' background and characteristics), Environment/Engagement (E) (learning processes and university environment), and Output/Outcome (O) (academic achievements and satisfaction). However, fragmented survey practices often lead to inefficiencies in institutional research, redundant data collection, and survey fatigue among students. The I-E-O-L model, an extension of Astin's framework, aims to address these challenges by integrating postgraduate data in a structured manner while primarily improving the efficiency and coordination of student surveys during enrollment [5][6].

While the Life Career (L) component highlights the importance of graduate outcomes, this study focuses on the broader role of the I-E-O-L model in optimizing student survey management. The discussion of L is positioned as a future research direction rather than a primary focus. Although the L-component deals with graduate data, its management and integration into institutional research align with the survey frameworks of I, E, and O. The I-E-O-L model allows for coordinated survey administration across all components.

Despite the utility of student surveys, significant challenges remain regarding their implementation in Japanese universities. Surveys are often conducted independently by administrative departments based on specific business needs, leading to fragmentation and lack of coordination across departments. This disjointed approach results in the following:

1. Redundant survey questions, causing survey fatigue among students.

2. For the efficient use of data, tabulation and analysis are frequently confined to individual departments.

3. Limited integration of survey data as panel data for IR.

To address these issues, this study explores the potential of the I-E-O-L model as a foundational framework for consolidating student surveys. By visualizing and mapping the timing, scope, and content of these surveys, universities can achieve a common understanding among stakeholders. This can then streamline operations and improve the sophistication of survey-based IR activities. Furthermore, these efforts can enhance collaboration across departments and ensure data-driven improvements in educational quality.

Furthermore, evidence from international higher education systems, including the UK's HESA Graduate Outcomes [7], the US's NSSE [8], the OECD AHELO project [9], and EUA reports [10], demonstrates that similar methodologies have been applied in various global contexts, reinforcing the generalizability of the I-E-O-L model.

This study aims to address these challenges by proposing the I-E-O-L model as a practical tool for managing student surveys, promoting and advancing IR activities, supporting evidence-based decision-making, and enabling the utilization of student survey results as evidence for institutional evaluation at Japanese universities.

2 The Proposal of the I-E-O-L Model: Extending the I-E-O Framework

The I-E-O model, proposed by Astin, has been widely used as a theoretical foundation for evaluating student learning outcomes and growth [3][4]. The I-E-O model comprises three key components:

- Input (I): Students' characteristics and prior experiences before entering university.
- Environment/Engagement (E): The learning environment and extent of student involvement with peers, faculty, and courses.
- Output/Outcome (O): Academic achievement and satisfaction levels observed during or after educational experience.

The I-E-O model is a well-known framework for evaluating academic and educational outcomes. This model, named after the initial letters of the three components of input, environment, and output, is still widely referred to as a basic theory for conducting student surveys and has been further developed by numerous researchers. In Japan, for instance, there are two notable models: the IEEO model by Yamada [11] and the comprehensive I-E-O model by Aihara [12], which consider the elements of student engagement. The latter model, in particular, posits that the learning environment encompasses not only institutional characteristics but also students' proactive involvement, including their relationships with their surroundings.

Currently, a survey of graduates is required to evaluate learning outcomes [3][13]. The survey items included utilization of learning outcomes, income, and employment status, which may have been considered part of the outcomes. However, the enrollment period is only one part of a student's lifespan, and students continue to accumulate various learning experiences after graduation. While surveys conducted during enrollment evaluate students' growth, postgraduate surveys measure graduates' activities in society—that is, their social impact [14]—or ask for another review and evaluation of their education at the time of enrollment, once again after their postgraduate experience [15].

Having developed Aihara's model [12], we propose the I-E-O-L model [5][6], which considers Life Career as a fourth component, with information obtained from a questionnaire survey of graduates.

- Life Career (L): Graduates' experiences and outcomes after leaving university, including employment status, income levels, career progression, and retrospective evaluations of their education. This component incorporates postgraduate data and provides a comprehensive understanding of the long-term impact of higher education.

While postgraduation information is included in the output/outcome component of the traditional model, it was necessary to consider the added effects of postgraduation experiences when using it to explain academic and educational outcomes. The university period constitutes only a part of an individual's life course. Thus, to make this explicit, we decided to treat postgraduation information as a fourth component, "L," which is independent of "O."

Various studies suggest that there is no single best method for collecting and analyzing postgraduation data. For example, the Higher Education Statistics Agency (HESA) [7] in the UK integrates administrative employment data, while the National Survey of Student Engagement

(NSSE) [8] in the US relies on self-reported survey responses from graduates. Similarly, the OECD's AHELO project [9] has explored international frameworks for assessing graduates' learning outcomes. These diverse approaches indicate that postgraduation data collection is context-dependent and must be adapted to institutional and national policies.

Previous studies on the I-E-O-L model have focused on different aspects of its development and application. One study [5] introduced the model as a framework for managing student surveys, while another [6] examined its alignment with the MEXT Guidelines. However, neither study explored its applicability beyond Japanese universities or addressed the methodological challenges of Life Career (L) data collection. This study extends the discussion by analyzing international implementations and proposing refined methodologies for integrating postgraduation data into institutional research.

Given that the collection of information on "L" will target graduates—that is, those who are not currently affiliated with a university—it will be more compatible with the operational aspects of the survey. Considering these factors, we revised the image of the I-E-O-L model, as shown in Figure 1.

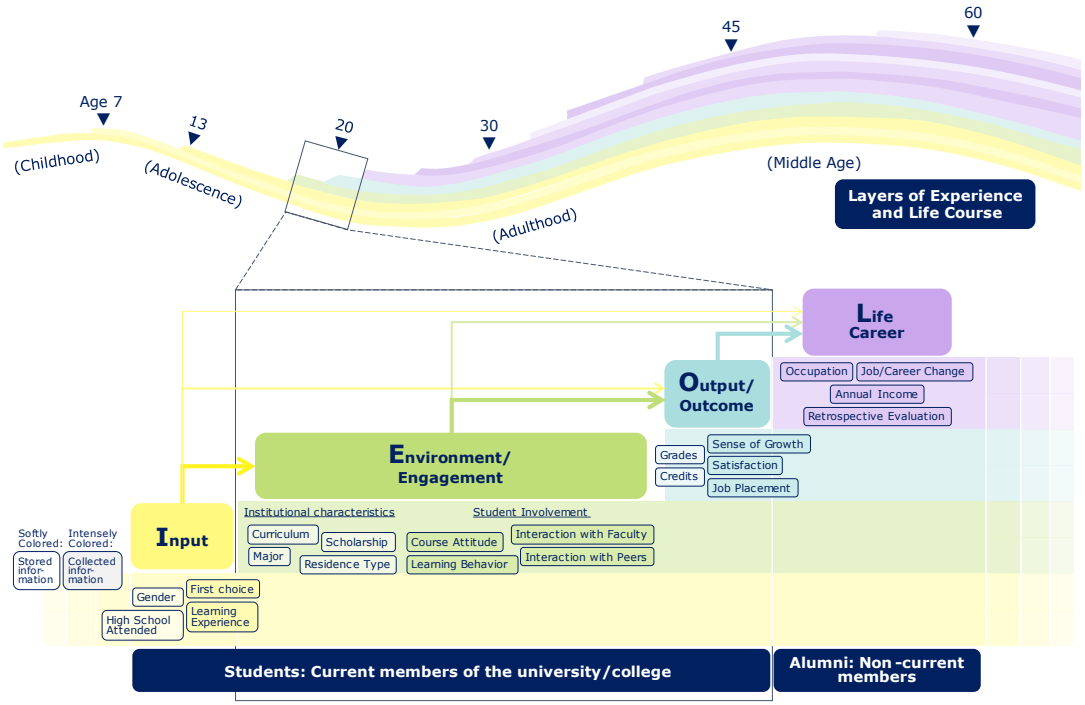

Figure 1: Revised image of the I-E-O-L model. The I, E, O, and L elements are presented in a layered format, along the time axis from left to right in the figure. At the top of the figure, layers of experience and the life course are illustrated. Adapted and updated from [5][6].

3 Case Studies of Problem Solving Using the I-E-O-L Model

This chapter introduces three case studies from our IR activities that address challenges related to student surveys. The first case highlights how the use of the I-E-O-L model to visualize the implementation of student surveys across various university departments helped establish a common understanding among stakeholders regarding the efficiency and sophistication of student

surveys [5]. The second case focuses on leveraging this shared understanding to review and improve survey items by examining the consistency between the I-E-O-L model and the Guidelines, with the aim of proposing a methodology for coordinating efforts between IR staff and survey administrators [6]. Finally, this chapter introduces a third proposal, "Inventorying Student Surveys," which emerged from the experiences of the two case studies.

3.1 Establishing a Common Understanding through Student Survey Mapping

Student surveys can be administered by a single university department. However, they are often conducted separately by individual departments in connection with their respective work. In the latter case, a department may not be aware of the surveys being conducted by another department, which could result in asking similar questions simultaneously or in difficulties aggregating and analyzing the results of each survey.

However, to evaluate and track students' growth and academic achievements from before enrollment through to graduation and beyond, it is necessary to reconsider and consolidate the separate surveys into a series of panel data collected at appropriate intervals based on the I-E-O-L model.

This helps improve efficiency, for example, by eliminating the duplication of question items, and makes the data more sophisticated by combining it with data from other surveys and analyzing it to obtain new findings.

Anegawa [16] examined more than 70 types of student surveys conducted at Waseda University and, referring to the I I-E-O model and trends at other universities, clarified problems in the university's student surveys and suggested specific ways to improve efficiency and sophistication. In addition, she developed enrollment management in the university's decentralized IR system (EMIR) and encouraged each relevant department to take charge of practical operations, from data collection to analysis, resulting in more efficient and sophisticated IR activities for the university as a whole [17].

To address these challenges, we developed a survey mapping matrix based on the I-E-O-L model. This matrix visually organizes the timing, content, and responsible departments of student surveys across the four components (Input, Environment/Engagement, Output/Outcome, and Life Career) [5].

Key Features of the Survey Mapping Matrix

The following outlines the construction of the Survey Mapping Matrix (Figure 2), highlighting its key features:

(1) Matrix Structure: The matrix organizes surveys with the components of the I-E-O-L model (Input, Environment/Engagement, Output/Outcome, Life Career) as rows and survey items as columns, based on Anegawa [16]. Survey timings and target grades are integrated into the matrix for a comprehensive overview.

(2) Survey Cards: Each survey is represented by a card containing six key pieces of information: 1) Department responsible for the survey, 2) Main theme of the survey, 3) Number of questions included, 4) Whether the survey is required or voluntary, 5) Method of data collection, and 6) Individual identification capability.

(3) Mapping Surveys to Components: Survey cards were placed at the intersection of their timing and relevant I-E-O-L component(s). Surveys covering multiple components were mapped

across the corresponding rows (e.g., a survey addressing both Input and Environment/Engagement for first-year students spans these components).

(4) Flexibility in Alignment: The timing of the survey and the I-E-O-L components do not always correspond exactly. For instance, surveys targeting first-year students may address elements from both the Input (background information) and Environment/Engagement (student experiences), thus requiring flexible mapping.

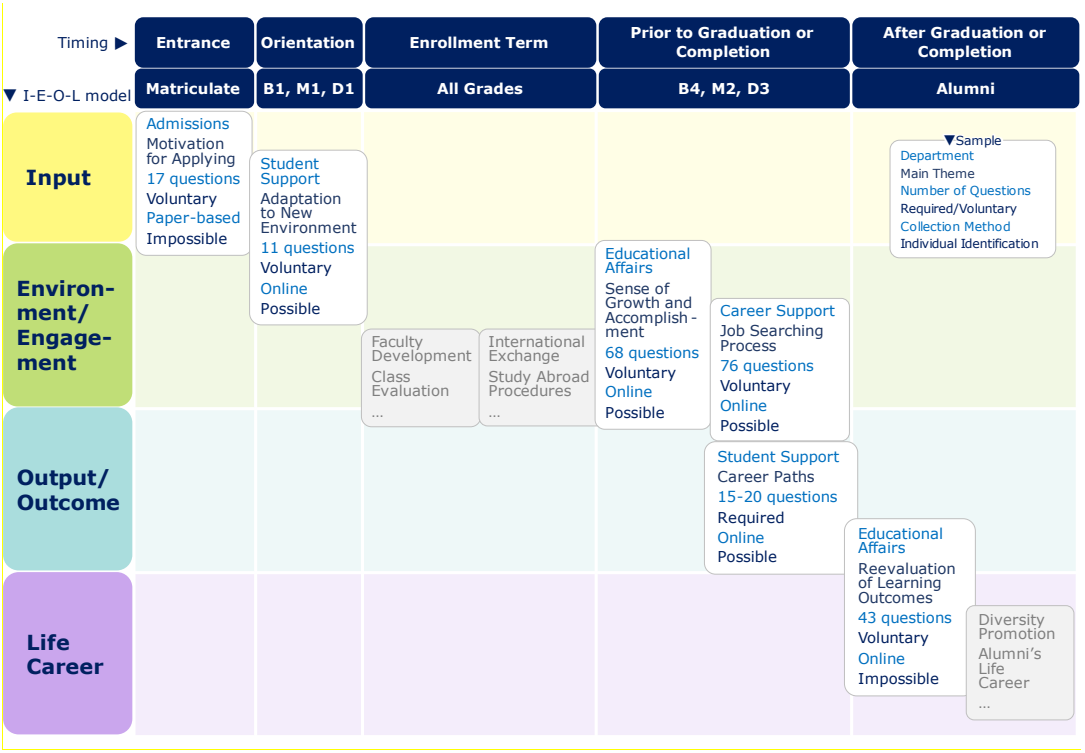

Figure 2: Example of mapping student surveys of undergraduate students using the I-E-O-L model. It should be noted that surveys involving advanced IR involvement are indicated in blue text, while those that do not are grayed out. Adapted and updated from [5][6].

Results of Implementing the Matrix

It is visualized such that the focus elements of each survey and the time of year are visible at a glance. From the observations shown in Figure 2, the characteristics of the implementation of the surveys on campus can be summarized as follows:

- Nine surveys were conducted on campus and mapped from top left to bottom right of the matrix.
- The departments responsible for the surveys were disparate. In addition, the tabulation and analysis remained within the survey.
- Currently, all surveys are online; however, some cannot be linked to individuals.
- Three surveys were administered before graduation and two were administered to graduates, and there appeared to be some overlap in the questions.

- Two of the three pre-completion surveys had a particularly large number of questions, which may have been burdensome for the respondents.
- Two of the three surveys for graduates were conducted by two different departments, and it is possible that the timing of the surveys overlapped.

Figures 1 and 2 consolidate the surveys administered to students in different parts of the university. Based on past efforts, it is believed that the I-E-O-L model (Figure 1) and the matrix (Figure 2) that uses it to visualize survey implementation will facilitate a common understanding among the parties involved in the following: 1) student surveys need to be designed based on the I-E-O-L model and 2) what grades are being surveyed, what surveys are being conducted, and by what departments; that is, each survey is always primarily responsible for one component of the I-E-O-L model.

Once this common understanding is reached, we can suggest ways to streamline and upgrade the surveys. As suggested by Anegawa [16][17], this refers to streamlining the questionnaire by consolidating duplicate questions. Survey sophistication can be achieved by collecting panel data through Individual Identification and combining them with other surveys for analysis.

If the above efforts are promoted sequentially within the university to reduce the burden on students who respond to the survey and to improve the efficiency of the survey process, we can move closer to an ideal student survey in which the necessary information is collected as panel data at an appropriate time. In addition, if it becomes possible to track students' growth and learning outcomes before and after enrollment to after they graduate, and gain new insights by combining and analyzing multiple surveys, then effective proposals may be made to help universities solve problems and improve the quality of education.

3.2 Aligning Survey Indicators with the Guidelines

In many cases, student surveys in Japan are conducted in a disjointed manner, with each survey planned and conducted based on the business needs of each administrative department of the university, independently of IR [16][17]. If the objectives of the administrative department conducting the survey do not align with those of the IR, the information provided by the I-E-O-L model alone may not be sufficient to create a common understanding among the parties involved, as described in the previous section, and cooperation in IR activities may not be forthcoming.

Nevertheless, despite the apparent incompatibility of the objectives of the two parties, if both initiatives contribute to university management, for instance, by demonstrating that the I-E-O-L model is highly consistent with the Guidelines set forth by MEXT, it may be understood that IR's involvement is largely due to external pressure, possibly prompting a compromise from the other party. This section examines the consistency of the I-E-O-L model with the Guidelines presented by MEXT, which is responsible for higher education policy in Japan. It also considers the potential of utilizing the results to promote the necessity for stakeholders to collaborate in designing student surveys in accordance with the I-E-O-L model. The viability of this approach has been previously discussed [6].

Consistency between the Guidelines and I-E-O-L Model

At the beginning of Chapter 3 of the Guidelines, entitled "Understanding and Visualizing Academic and Educational Outcomes," the following statements are made: (1) It is essential for both students and the university to have an accurate understanding and visualization of their academic and educational goals. This enables them to be aware of their current achievement status

and to strive for improvement, maintenance, and enhancement. (2) It is necessary to integrate multiple pieces of information in a multidimensional manner, recognizing that there are inherent limitations to understanding and visualization.

In his work, Astin [3] asserted that monitoring student growth using the I-E-O model and returning the results in an appropriate form to each student and university is crucial for achieving their respective goals and that an extension of Astin's model builds upon this idea, which is also consistent with statement (1).

Furthermore, Astin notes that student development is influenced by both the university and external factors such as maturation and the extracurricular environment. Therefore, when evaluating academic and educational outcomes, it is essential to consider not only Output/Outcome information but also multiple inputs and Environmental/Engagement factors that may influence the outcome. The I-E-O-L model also adheres to this perspective and aligns with statement (2).

Chapter 3 of the Guidelines classifies the information to be collected into the following two categories and provides some specific examples: (a) basic information associated with the educational activities of a university, which is considered collectible by all universities; and (b) information that is expected to be collected at the discretion of each university in establishing academic management.

Table 1 presents illustrative examples of this information, classified according to the I-E-O-L model. However, the specific data required to evaluate the components of Environment/Engagement and Life Career may vary depending on the educational content of each university.

The evaluation of academic and educational outcomes using postgraduate information or life careers was as follows: the time spent at university is only one aspect of a person's life (Figure 1); students gather learning experiences before entering university and continue to accumulate new experiences after graduation. As Astin noted above, students also learn from their experiences outside college [3].

While university education may indeed exert a significant influence on graduates' outcomes, postgraduate information introduces an additional factor not accounted for in the university's assessment, namely postgraduate experience. Thus, in evaluating academic and educational outcomes, greater attention will likely be required when collecting and analyzing information for L than for the I, E, and O components that can be collected during the school year.

Regarding postgraduation, this may be one of the limitations of the study, as pointed out by both the Guidelines and Astin. The Guidelines classify postgraduation information under category (b) above, leaving it up to each university to decide what information to collect, while Astin's study [3] focuses on outcomes that can be observed while students are still at university. Future research is required to evaluate academic and educational outcomes after graduation.

At this juncture, the design of the student survey in accordance with the I-E-O-L model is deemed to align with the Guidelines, largely because of its inherent characteristics. These include its suitability for monitoring student growth and its commitment to conducting a multidimensional evaluation based on multiple pieces of information, while acknowledging the limitations of the evaluation of the components, including L.

Effectiveness in Promoting Cooperation among Stakeholders

It is challenging to systematically redesign a series of student surveys that have previously been conducted in a piecemeal fashion with no clear connection to IR. Moreover, as the surveys have been designed based on the needs of each administrative department and their results have been utilized to a certain extent, universities may become increasingly reluctant to alter their content and methodology unless there are significant drawbacks [18].

However, the current approach to conducting surveys is fragmented, resulting in fatigue

among students and faculty members. The Guidelines recommend coordination among departments when conducting surveys to enhance efficiency and sophistication, recognizing that time is finite for all stakeholders. The reception of this approach may be greater if universities are made aware that it is not only the opinion of IR staff but also a guideline for higher education policy, that is, a request from the national government.

Table 1: Examples of Information Collected for Understanding and Visualizing Learning Outcomes/Educational Achievements from the Guidelines [1][2]. Reproduced from our previously published work [6].

I-E-O-L Model	(a) Basic information related to university educational activities, which is expected to be collectible at all universities	(b) Information expected to be collected under each university's discretion for establishing academic management
Input	• Tracking survey of methods used for university admissions selection (grades, activity records, rates of repeating a year or dropping out) • Factors such as age, gender, disability, nationality, family background, and residential area	—
Environment/ Engagement	• Achievement status of learning objectives in each course subject. • Study hours*	• Direct assessment of achievement status in course subjects that can evaluate specific qualities and capabilities defined in the "graduation certification and degree conferral policy." • Results of assessment tests • Scores from external examinations such as language proficiency tests* • Status of qualifications acquired, awards, and recognitions*
Output/ Outcome	• Degree acquisition status • Students' sense of growth and satisfaction • Post-graduation status such as progression rates to further education or employment • Proportion of students graduating within the scheduled period, rates of repeating a year, and dropout rates	• Standard of graduation thesis or research
Life Career	—	• Evaluation of graduates • Graduates' evaluations of the university*

* Data collected through surveys and interviews targeting students and graduates.

3.3 The Third Proposal "Inventorying Student Surveys"

Through IR activities, including those discussed in Sections 3.1 and 3.2, we have identified the following challenges in student surveys. The first issue, as described in Section 3.1, is that surveys conducted by separate administrative departments often lead to fragmentation, redundancy, and inefficiencies in data utilization. Second, while survey items in ongoing student surveys are periodically added to address educational reforms or social changes, there is often hesitation about removing outdated or redundant items. As a result, the number of survey items tends to increase over time.

Through these case studies, the I-E-O-L model demonstrates its potential to enhance the management and utility of student surveys. Specifically, these initiatives have gradually fostered a

shared understanding among survey stakeholders regarding the importance of improving efficiency, advancing sophistication, and reducing the burden on students. Consequently, even departments that were previously reluctant to review and revise their surveys have begun actively participating in efforts to streamline and optimize their practices.

Concerns About Declining Accuracy Due to Survey Fatigue

These challenges appeared to increase the burden on both students who participated in the surveys and the staff responsible for their administration. Consequently, as seen in the implementation status of the graduation surveys in Figure 2, students may experience survey fatigue because of the frequency and volume of the survey questions. This can lead to dropouts or diminished motivation, raising concerns about the accuracy of survey results.

Indeed, as part of our IR activities, we aggregate and analyze questionnaire data collected by various departments. Prior to this, we examined the response status for each survey question and found that mid-survey dropouts are not rare but occur relatively frequently [19].

In addition, to consider survey designs that minimize psychological stress for respondents, we have investigated the number of questions and required completion times for commercially available short-form psychological testing tools [20]. Many of these tests consist of single-choice questions, with approximately 60 questions considered the upper limit. The expected time per question is approximately 10 seconds, or roughly 10 minutes in total. This suggests that minimizing the psychological burden on respondents is key to obtaining more accurate survey responses.

Toward Student Surveys That Contribute to Educational Improvement

As indicated in the Guidelines, it is necessary to evaluate academic and educational outcomes and utilize the results to improve education [1][2]. To achieve this, it is crucial to collect information systematically each year. This allows for tracking student growth during their university years, observing longitudinal changes, and understanding shifts.

However, the scope of surveys is inevitably limited and may not always comprehensively cover everything. As educational content evolves with societal changes, it is necessary to periodically review survey items and questions to ensure that they effectively measure what needs to be measured.

The Guidelines discussed in Section 3.2, as well as Astin's work [3][4], emphasize that student surveys should focus on meaningful content and practical application rather than on formal exercises. This suggests that student surveys should not be treated as isolated efforts but reviewed systematically as part of a broader framework. It also underscores the need to evaluate the appropriateness of the survey items and number of questions based on the response data.

Visualizing the implementation status of student surveys using a matrix based on the I-E-O-L model is effective in addressing the former. Visualizing the response rates for individual survey questions can provide valuable insights.

Proposing "Inventorying Student Surveys"

The "Inventorying Student Surveys" approach systematically addresses fragmentation by consolidating disparate surveys, reducing redundancy, and enhancing data validity and reliability. Improving student surveys through these visualization methods is akin to the inventory management process used to monitor stock levels, discrepancies in records, and item quality. We term this approach "Inventorying Student Surveys" (Figure 3) and recommend it as one of the essential tasks in IR activities related to education.

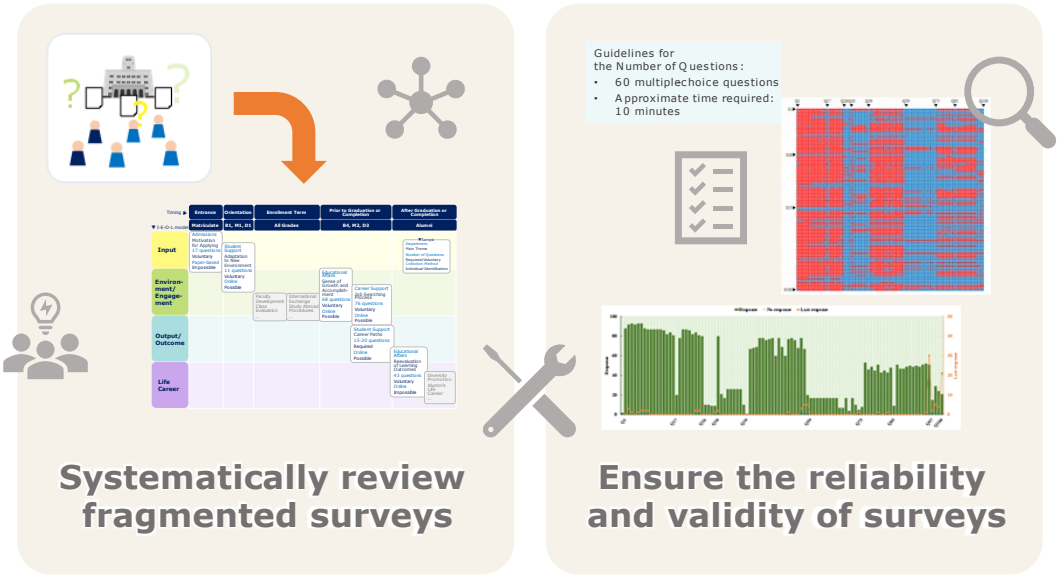

Figure 3: A Dual Approach to Inventorying Student Surveys. This figure illustrates two approaches to inventorying student surveys: (1) systematically reviewing fragmented surveys using the I-E-O-L model matrix, and (2) ensuring reliability and validity by monitoring response rates, optimizing question volume, and reducing respondent burden. These approaches aim to improve survey efficiency and support educational enhancement.

4 Discussion

This study aims to advance IR activities by identifying challenges in student surveys and providing concrete proposals for their resolution. By extending the traditional I-E-O model, we propose a new framework, the I-E-O-L model. Using this model, we demonstrate, through case studies, how to address the issues inherent in current student surveys. Based on the insights gained from these cases, we offer recommendations to ensure that student surveys effectively contribute to academic management.

The I-E-O-L model provides a structured framework to visualize survey timing, align different survey components, and minimize redundancy, thereby improving overall data utilization in institutional research. This framework enables institutions to manage student surveys more efficiently by reducing duplication and enhancing data consistency across various research activities.

The I-E-O-L Model: Enabling Comprehensive Evaluation

The I-E-O-L model is an extended framework that incorporates "Life Career (L)" into the traditional I-E-O model [3][4], providing a new perspective for comprehensively evaluating student growth and learning outcomes. The I-E-O-L model extends the widely recognized I-E-O framework by incorporating a longitudinal perspective, making a significant contribution to the evaluation of educational outcomes in higher education. This longitudinal approach enables the integration of postgraduate data such as career development and social activities, offering a more holistic understanding of student development over time.

By treating elements such as postgraduate social activities and career development as an independent category, the model enables analyses that consider not only in-college outcomes (Output)

but also the long-term impact after graduation. This framework serves as a foundation for systematizing and integrating otherwise fragmented student surveys into panel data, enhancing survey efficiency while offering a sophisticated tool for generating insights to support academic management.

Proposals for Integrating and Enhancing Student Surveys Using the I-E-O-L Model

The I-E-O-L model is an effective tool for systematically organizing university-wide student surveys and addresses challenges such as redundancy and inefficiency [5]. In the first case study, a matrix was developed with the components of the I-E-O-L model on the vertical axis and survey timelines on the horizontal axis. Cards containing information about each survey (e.g., responsible department, survey name, and number of questions) were mapped onto the matrix. This tool made it possible to visualize redundancies and inefficiencies in the surveys, fostering a shared understanding and collective action among stakeholders involved in student surveys to resolve these issues.

Demonstrating that the I-E-O-L model aligns with the Guidelines [1][2] is a highly effective approach for gaining cooperation from stakeholders involved in student surveys [6]. The second case study showed that the Guidelines require universities to accurately understand and visualize learning outcomes and to utilize this information to improve education and promote student growth. The I-E-O-L model aligns with these objectives by serving as a tool for monitoring student development and enabling a multidimensional evaluation. Emphasizing this alignment, particularly by referencing the Guidelines as an external pressure, proves to be an effective means of fostering a shared understanding and strengthening the willingness to cooperate among stakeholders.

To effectively utilize student surveys, it is essential to conduct regular reviews and re-visions, continuously improving survey items and question content [19]. The third case study pointed out that as the circumstances surrounding universities evolve, new questions are often added, while existing questions are rarely removed, leading to an overall increase in the survey burden. As in the first case, this can heighten the psychological burden on respondents and potentially decrease the accuracy of their answers. Therefore, it is necessary to set upper limits on the number of questions and response times during the survey design phase to alleviate this burden [20]. In this case study, the need to check the reliability and validity of surveys was emphasized, in addition to addressing the redundancy and inefficiency of surveys. This approach was likened to inventory management and proposed as the "Two Types of Inventorying."

Applicability and Future Challenges

One of the novel aspects of the I-E-O-L model, the "Life Career (L)" component, provides a critical perspective for capturing the long-term development and outcomes of students. However, as discussed in Section 3.2, this component is influenced by a broader diversity of factors than the college period, which requires careful consideration during data collection, analysis, and interpretation. Furthermore, determining how (or whether) to evaluate alumni data remains an area that demands further research and stands out as a significant challenge for the future.

Although the I-E-O-L model offers a framework for organizing the information necessary to evaluate learning outcomes, it does not specify the details of the individual elements or methods for their evaluation within the I, E, O, and L components. Nevertheless, its inherent flexibility makes it adaptable to the educational systems and cultural contexts of different countries, as well as the unique educational philosophies and goals of individual universities. Consequently, its inherent flexibility renders it applicable not only in Japan but also globally, where it can be adapted to the educational systems and cultural contexts of other countries, as well as the unique

educational philosophies and goals of individual universities.

5 Conclusion

In this study, we propose the I-E-O-L model, an extension of the traditional I-E-O model, as a comprehensive framework for managing and administering student surveys to promote Institutional Research (IR) on education. The following key findings were highlighted in the three case analyses:

1. The I-E-O-L model facilitates shared understanding among university stakeholders by visualizing the implementation status of student surveys and promoting efficiency and sophistication in survey management.

2. The model aligns with the Ministry of Education, Culture, Sports, Science and Technology's (MEXT) Guidelines for Academic Management, underscoring its relevance and utility in higher education policy.

3. Regular systematic reviews and "inventorying" of fragmented surveys are essential for ensuring the reliability and validity of survey data.

These findings suggest that applying the I-E-O-L model has significant potential for tracking students' growth and learning outcomes while improving the quality of education. However, rather than delving into detailed methodologies for postgraduation data collection, this study emphasizes the model's role in improving student survey management. Future research should explore the implementation challenges of collecting and integrating Life Career (L) data while further assessing the international applicability of the model.

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