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Elucidating the Impact of Leadership Behavior Education on the Gender Gap: Short and Long-Term Cases of Young Women in Tokyo, Japan

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Abstract

This study aimed to elucidate the impact of leadership behavior education in gender -gap countries, using the case of young women in Tokyo, Japan. As a research method first, It be used Data 1 creating a predictive model based on five topics using LDA in topic modeling. It be then extracted 100 words that make up each topic. It be named the topics using the top 20 words. Topic 1: Competence & Responsibility; Topic 2: Goals & Communication; Topic 3: Leading & Involvement; Topic 4: Listening & concern; Topic 5: Gender Equality. Next, we used Data 2 to verify the model created using Data 1. Furthermore, we decided to use data 3 and 4 to observe both the short-term and long-term effects of education.The results showed that Data 2, 3, and 4 all showed the same trend, indicating that the model created for the leadership behavior of young women in countries with high gender gap indices could explain the situation well. Topic 1: Competence and responsibility were highly high in Data 2, 3, and 4, and this could be said to be a characteristic of young women's leadership behavior in countries with high gender gap indices. Furthermore, the low scores for Topic 3: Leading and Involving and Topic 2: Goals & Communication suggest the need to foster these behaviors through education. Further consideration revealed that the effects of leadership education were similar in the short term and the long term, but the long-term effects were more variable.

Keywords: Leadership, Leadership Behavior Education, Gender Gap Country, Young Women

1.0 OBJECTIVE AND BACKGROUND

This study aims to elucidate the impact of leadership behavior education on reducing the gender gap, using the case of young women in Tokyo, Japan. In recent years, the demand for women leaders has increased globally. Companies with more women on their boards of directors perform significantly better than those without, and organizations with greater gender diversity in senior management are also more profitable (Amar, 2023). Despite these advancements, the proportion of women in senior management roles worldwide remains low.

The percentage of women in senior positions is significantly lower in almost all industries, and men far outnumber women in these upper echelons (Amar, 2023). This imbalance in the status of men and women is lamentable, especially in many countries that are considered developed countries and where there are laws against gender discrimination (Kassotakis, 2024). Historically and culturally, the tendency for women to be undervalued as leaders within human groups and organizations is contradictory, as there is no clear and definitive evidence that the performance of female leaders is inferior to that of men. In addition, it has been found that women clearly influence group decision-making and behavioral change in small human societies and family systems (Smith et al., 2021). In other words, in certain situations, women become leaders, and female leadership is widespread.

The need for more women in leadership positions is not only good for gender equality but also for business performance (Ely et al., 2020). However, some developed countries continue to exhibit high levels of gender disparity, with Japan being a notable example (Gender Equality Bureau, Cabinet Office, 2021). On International Women's Day, *The Economist* ranked Japan 27th out of 29 countries for ease of working for women (The Economist, 2023), indicating that leadership in Japanese society remains highly gender-differentiated. According to this report, only 14.6% of management positions in Japan are held by women (OECD average: 34.2%), and only 10.3% of Diet members are women (OECD average: 33.9%). In response, the Federation of Economic Organizations (2021) set a target to increase the proportion of women on corporate boards to at least 30 percent by 2030.

Gender differences in leadership have been explained by role compatibility theory (Eagly, 2003a; 2003b; 2002; 2001; 1990; 1984) and other theories, which categorize leadership traits as inherently feminine or masculine. Women who take on leadership roles are expected to balance their gender roles with the traditionally masculine traits associated with leadership. This role conflict often confuses women and those who value their leadership, leading to negative self-consciousness and a detrimental impact on behavior and attitudes.

In recent years, leadership has increasingly been viewed as an acquired skill that can be developed through training and experience (Adair et al., 2011; 2011). It will be a methodology and system of leadership behavior. This behavior will demonstrate leadership and the

only means of becoming a leader. It is thought that this will help to solve problems in organizations and situations rationally as tactics.

Prominent female leaders, including German Chancellor Angela Merkel, British Prime Minister Margaret Thatcher, and Philippine President Corazon Aquino, exemplify this shift. Countries such as Ireland, New Zealand, and the Philippines have even produced multiple female prime ministers or presidents (Gender Equality Bureau, 2007). Women leaders are also active in industry and the business world. For example, Julie Sweet is the first female CEO in Accenture's history and is at the top of a company with 500,000 employees (Accenture, 2019). As of September 2024, Accenture's website lists 50 people as leaders of the company. Approximately 30% of these are women, and the company is taking on the challenge of gender equality. Sheryl Kara Sandberg is the COO (Chief Operating Officer) of Facebook (currently Meta), who was selected as one of the "50 Most Powerful Women in the World" by Fortune magazine. She is famous for her call to "step out of the current situation" (lean in) in her book.

Looking at the current social situation, particularly in the fields of politics and economics, the development of women's leadership will continue to grow. Several institutions are also thought to offer programs specifically for women leaders (Kassotakis, 2024). However, women remain underrepresented in higher education leadership education. This is a particularly pressing issue given the anxious society post-COVID-19 and the increasing rate of female students entering higher education (Baltodano, 2012).

The research question of this study asks: What are the leadership behavior strategies of young women in high gender-gap countries who will lead their nations in the future? Identifying these strategies is significant, as it could provide valuable insights into developing women's leadership in such countries.

■2.0 REVIEW OF PREVIOUS STUDY AND POSITIONING OF THIS STUDY

2.1 Gender Differences in Leadership

After the war, there was a change in the role of women in the economy and the driving force behind women's participation in employment and the labor market, and there is still a gap between men and women. Despite the convergence of gender trends, the remaining gender gaps in wages, employment levels, and the types of activities undertaken by men and women in the labor market appear to be surprisingly persistent, even though educational gaps have been reversed in most countries and legislation on equal treatment has become more stringent. Olivetti et al. (2016) suggest that the gender gap may be rooted in gender differences in productivity and preferences or in labor market discrimination.

The most advanced research on gender inequality in the labor market up to the end of the 1990s is reviewed in Altonji (1999) and other literature. The review states that the leading cause of gender inequality depends on how much human capital has accumulated. When looking at the differences in leadership behavior between men and women from a historical and cultural perspective, gender stereotype expectations have led to women demonstrating leadership in an interpersonal-oriented style and men demonstrating leadership in a task-oriented style (Eagly et al., 1990). Eagly et al. (1990) reported that women's responses to the stereotype expectations were still present and that women tended to adopt a more democratic or participative style than men and a less autocratic or directive style. However, on the other hand, a meta-analysis also stated that there was no difference between the two leadership styles for women and men in "organizational research".

Abdulrahman (2020) stated that classical and authoritarian leadership still dominates the prevailing organizational and work methods despite the changing society. However, is this authoritarian leadership still applicable? Considering the chaotic society of today, there is a possibility that new female-oriented leadership styles and behaviors can address many problems that have been exacerbated. Furthermore, Abdulrahman (2020) stated that companies should always look for alternatives to reduce problems and dilemmas, increase efficiency and effectiveness, and increase innovation and employee satisfaction. Perhaps one of the alternatives to authoritarian leadership is leadership behavior with positive female characteristics.

Given the COVID-19 pandemic and the rise of generative AI, the value of human capital is considered equal for both men and women. When considering modern male leadership, it is possible to learn from, incorporate, and effectively use female leadership styles and leadership behaviors. In other words, effective leadership is not the sole domain of either gender, and both can learn from the other.

According to Appelbaum (2003), there is no reason why women's leadership styles and leadership behaviors should be less effective for organizations. In fact, in the context of the team-based, consensus-oriented organizational structures that are becoming more common today, women's styles are more effective. The assessment that women's leadership is less effective than men's is not based on fact, as described by Eagly et al. (1990) and Abdulrahman (2020), but is driven by perceptions that are certainly perpetuated by socialization.

2.2 Leadership Behavior Theory

Leadership is among the most discussed and debated topics in academic fields such as business administration (Avolio et al., 2003). Avolio et al. (2003) state that the theoretical agenda in the field of leadership study has evolved from focusing on the internal qualities associated with influential leaders to recent study that emphasizes behavior and other aspects, with the recognition that leaders and followers are dynamically embedded and interact (Derue, 2011). Moreover, research on leadership usually distinguishes between leaders and non-leaders and begins with the search for genetic characteristics that explain the effectiveness of individuals as leaders (Galton, 1869).

Early research on leadership began the trait paradigm in leadership research. It has been established that individual characteristics such as demographics, skills and abilities, and personality traits can predict leadership effectiveness (Derue, 2011 and many other previous studies). However, as criticism of the traits paradigm in leadership increased, research focused on the leadership behavior paradigm, which looks at how leaders' behavior predicts organizational performance, satisfaction with leaders, and other aspects of effectiveness.

Behavioral theory is the next mainstream leadership theory after trait theory. It is a theory emphasizing the acquired element of "behavior" not found in trait theory. It focuses on the patterns and routines of behavior commonly seen in people who demonstrate excellent leadership and seeks to elucidate the essence of leadership.

This leadership behavior paradigm can be seen in the managerial grid of Blake et al. (1964). This theory looks at leadership from two perspectives: the manager's interest in production work and the manager's interest in people. A theory classifies these into eighty-one patterns, each rated on a scale of nine and five types of leadership. Fiedler's (1967) contingency model holds that leadership styles will only produce the best performance in situations. He argued that leaders are required to appropriately change the organization's management policies in

response to changes in the environment. He also defined the conditions for leadership effectiveness in terms of three situational variables. Other theories, such as PM theory by Misumi (1966), will be discussed later. In this way, the study paradigm on leader behavior provided a valuable theoretical foundation for leadership study.

2.3 Leadership Behavior Tactics Among Young People And Education

Initial studies on leadership behavior tactics focused primarily on the workplace (Seibert et al., 2017). Since the 1990s, however, discussions on leadership behavior tactics for young people, have gained traction globally. Kouzes (2024) highlighted university students as exemplary leaders and discussed behavior tactics that enable them to become effective leaders. Watanabe (1997) noted that the growing interest in leadership research, particularly in the USA, stems from the need to cultivate leadership capable of navigating a fluid and uncertain business environment.

Following these international trends, Japanese universities have also engaged in discussions on leadership behavior tactics for young people (Tateno et al., 2018). Recently, particular attention has been given to leadership behavior tactics that incorporate experiential learning theories, particularly rooted in U.S. leadership models (Day, 2001; Seibert et al., 2017). Tateno et al. (2018) and Higano (2018) spearheaded this approach, and making it a significant educational outcome in Japan. However, cultural differences between countries have raised concerns about the applicability of foreign leadership theories to Japan (House et al., 2004). Many scholars argue that directly applying overseas models to Jais challenging (Kimura et al., 2019; Imai, 2014).

In cases where foreign theories may not be suitable, leadership frameworks used in Japanese companies, such as PM theory (Misumi, 1966), could be considered. However, these theories assume hierarchical relationships in the workplace, which are less applicable to the relatively flat dynamics perceived by young people. Thus, such models may not be appropriate for discussing leadership behavior tactics in this context.

2.4 Leadership Behavior Tactics For Young Women And Education

The discourse surrounding women's leadership has also expanded. Historically, Haraway (1985) addressed women's experiences, both real and fictional, through a lens of radical feminism, using cyborg imagery to interpret oppression and envision possibilities for a gender-equal society. Haraway argued women were forced to become cyborgs, adapting to their environment through artificial means.

In contrast, however, women's qualities have proven valuable in leadership behavior. Gerzema (2013) proposed the concept of “goddess leadership” and, through a survey of 64,000 people in 13 countries, found that many of the traits exhibited by successful entrepreneurs and leaders worldwide were of a “feminine” nature, regardless of ideology or culture. For example, these qualities include being “sincere,” “altruistic,” “empathetic,” “expressive,” and “patient.”

The study further argues for the need for leadership by both women and men who “think like women.” The Athena Doctrine theory, or “goddess leadership,” introduced an image of leadership characterized by a “flexible intelligence,” different from the so-called transformational leadership described in the formal image of transformational leadership. Ely (2011), in her research on leadership behavior and the career development of young women in gender-biased environments, conceptualizes a gendered women's leadership development program as identity work and supports the rationale for teaching leadership in women-only groups. This highlights the potential for leadership to be nurtured in such settings.

Focusing on female students in Japan, there has been a rapid shift in recent years towards recommending the development of leadership behavior tactics (Kyouritsu Gakuen Jyoshi, n.g.). In other words, women's leadership behavior tactics are increasingly seen as skills that can be acquired by anyone, regardless of gender or age, and their necessity and importance are being actively being discussed (Higano, 2018) Naito et al. (2020), Anzai (2013), and Kawami (2004) emphasize that enhancing leadership education is one of the key issues for young women in Japan in the 21st century, highlighting the need for young women to learn leadership behavior tactics.

2.5 Natural Language Processing Study To Understand The Attitudes Of Young People

Various research methods can be considered when examining leadership behavior tactics among young women. Classifications such as quantitative and qualitative research, as well as review and empirical studies, exist (Jessica, 2023). For quantitative research, existing scales can be used. Kimura et al. (2019) developed survey questions based on the analyst's interpretation of relevant leadership behavior scales from existing research.

Quantitative surveys offer the potential for generalizability, ensuring objectivity and reproducibility, and allowing for statistical analysis. However, these studies may also have limitations. They can rely on standardized analytics that overlook the complexity of participants’ experiences and perspectives, fail to recognize the importance of context, and ignore the influence of subjective data interpretation (Ragin, 2011).

On the other hand, qualitative analysis provides a more comprehensive understanding of a phenomenon through rich, detailed data on the subject. It is adaptable and flexible, often leading to new and unexpected discoveries. By allowing for contextual and subjective data interpretation and recognizing patterns and themes in the data, qualitative research can generate hypotheses for future research. However, qualitative studies face limitations in terms of generalization. They can be influenced by the researcher's bias and personal perspective, are time-consuming, and may not always yield significant insights from new information (Ezzy, 2002).

This study integrates natural language processing, a machine learning-based analysis that combines the strengths of both quantitative and qualitative research. Matsumoto (1992) and IBM (n.d.) describe the technical approach to natural language processing as a system that derives the most appropriate analysis results from ambiguous sentences.

Two primary approaches are often used to analyze natural language data quantitatively: dictionary-based and correlational-based methods (Higuchi, 2014). The former requires a dictionary model of words to examine respondents' attitudes. In models that collect and display words, the classification and arrangement of words are closely related to the model’s purpose and are useful for understanding phenomena and concepts. Therefore, creating a model tailored to its specific purpose is crucial.

An additional challenge lies in overcoming the difficulties of natural language processing in the Japanese language. In this regard, Mizumoto et al. (2011) stated that an automatic error correction method using statistical machine translation (SMT) is a promising approach. The advantage of this method is that it does not require specialized knowledge. The correction model is trained from a corpus of aligned and corrected sentences.

■3.0 METHOD

3.1 Analysis Flow

This empirical study involves a four-stage analysis using four types of data (Figure 1). This analysis employs a hold-out method, which classifies the data into training and validation sets and evaluates the models separately. In this study, the data from Survey 1 (Data 1) is used as training data to create a prediction model (PART 1). The model's accuracy is then assessed by evaluating the predictive model using the data from Survey 2 (Data 2) as the validation set (PART 2). Once the model's accuracy is confirmed, the impact of leadership education is measured. Data from survey 3 and 4 (Data 3 and 4) are used as measurement data to observe the short-term (PART3) and long-term impact (PART4). All analyses were conducted using Python 3.12.

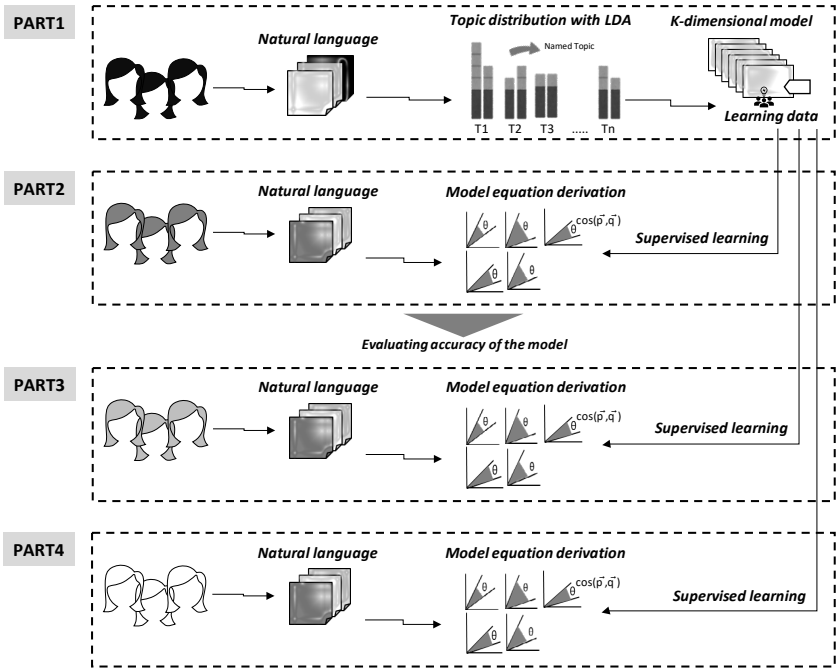

Figure 1 The analysis flow
(*PART1: Creating a prediction model; PART 2: Evaluation of the model; PART3: observation of the Impact of Leadership education short-term; PART4: observation of the Impact of Leadership education long-term)

3.2 Data Acquisition

Four surveys were conducted to collect the data. Surveys 1, 2, and 3 were carried out in two leadership class for sophomores and above at a women's university in Tokyo, Japan's capital. These were elective class, meaning that the young women who enrolled were motivated to acquire leadership behavior tactics. The curriculum structure was the same for FY2023 and FY2024.
A limitation of the in-class surveys was a bias in the students' grades, ages, and departments. Therefore, this information was not collected as attribute data.

The surveys were conducted in two classes (Survey 1: 5-12 April 2023, Survey 2: 11-13 April 2024, Survey 3: 19-26 July 2024) with approval from the Ethical Review Committee of the university. The surveys were anonymous and self-administered via the Internet. The questions were designed using the Sentence Completion Test (SCT) method, following Shirai et al. (2009), beginning with, "What leadership behavior means to me."

In addition, Surveys 2 and 3 were conducted on the same subjects and were carried out in the first and final (15th) lessons of the leadership education class, so it is possible to observe the effects of the educational intervention.

Survey 4 was conducted by a research company as a web-based survey (Survey 4: 11-12 March 2024). The same questions were asked as in the other surveys, in an anonymous and self-administered format, targeting young working women aged 24-27 living in Tokyo. According to Shirai et al. (2009), women living in regional cities and those living in the Tokyo metropolitan area have significantly different

attitudes toward society. To minimize variations in attitudes based on place of residence, the target population for this study was limited to Tokyo residents.

Furthermore, Data 4 was conducted on young women who had received leadership education. Although it was not a class conducted in Surveys 1, 2, and 3, it was set as a target for observing the long-term effects of leadership education.

3.3 Creating A Predictive Model (PART 1)

In creating the predictive model, Data 1 was used. First, the text data were pre-processed: morphological analysis using MeCab (Kyoto University, Graduate School of Informatics, Nippon Telegraph and Telephone Corporation, 2004) was performed to select the parts of speech to be included in the analysis.

The selected parts of speech were nouns, verbs, adjectives, and adjectival verbs, as it was considered necessary for the lexicon to consist of words with conceptual meaning. For ethical reasons, proper nouns, such as names of organizations, people, and places, were excluded. Additionally, words without conceptual meaning were removed, and kanji and hiragana were integrated into the same word to maintain consistency.

Next, stop words were set. According to Kunifu et al. (2013), stop words should be selected based on high-frequency words. For instance, the top 20% of words based on frequency should be identified and removed. Words with intermediate meanings and words that occur only once were also excluded. This study followed the approach outlined by Kunifu et al. (2013).

A predictive model comprising dimensions was then created from the pre-processed Data1. Following Iwata (2015), Latent Dirichlet Allocation (LDA)was applied. LDA assumes that one text data set contains multiple topics, and it captures these topics within the measures. This method also involved removing words without conceptual meaning as integrating kanji and hiragana into the same word.

LDA is based on Bayesian statistical models, which consider the generation process based on word occurrence patterns in a text (Blei et al., 2003). Predictive models created using such methods have a thesaurus-like structure. Consequently, the model can be viewed as a k -dimensional prediction model, where topic k represents the upper concept, and the words w that make up topic k represent the lower concepts.

For text data d set D, the generation of topic $z_{d,i}$ for the i for word $w_{d,i}$ of document d and the generation of word w for topic k are calculated as follows:

$d \in$ D

$$p(z_{d,i} = k \setminus \theta_d) = \theta_{dk} \quad (1)$$

$$p(w_{d,i} = v \setminus z_{d,i} = k, \beta) = \beta_{kv} \quad (2)$$

Where:

$p(z_{d,i} = k \setminus \theta_d) = \theta_{dk}$ is the probability of topic k being generated in text data d, sampled from a k -dimensional Dirichlet distribution θ_d indicating the mixing ratio of d.

$p(w_{d,i} = v \setminus z_{d,i} = k, \beta)$ is the probability of word w being generated in topic k, sampled from a V -dimensional Dirichlet distribution β indicating word distribution of topic k. Topics k can also use Perplexity (measuring the model's predictive performance) and Coherence (assessing the quality of the extracted topics) as reference indicators. $Contribution(w, k)$ of word w comprising topic k is then calculated using the following formula:

$$perplexity = \exp\{-\frac{\sum_{d=1}^{D} \log p(w_d)}{\sum_{d=1}^{D} n_d}\} \quad (3)$$

Where:

N_d : total number of words in text data d

$p(w_d)$: likelihood of word sequence w_d in text data d

$$coherence = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (w_i, w_j) \quad (4)$$

Where:

(w_i, w_j) : similarity between words w_i and w_j

The contribution of each wordw_i in topic k, $Contribution(w_i, k)$, is calculated as follows:

$$Contribution(w_i, k) = \frac{TF-IDF(w_i, t)}{\sum_{j=1}^{n} TF-IDF(w_j, t)} \quad (5)$$

Where:

$TF - IDF(w_i, t)$: $TF - IDF$ of word w_i in topic k

$\sum_{j=1}^{n} TF - IDF(w_j, t)$: Total $TF - IDF$ in the top n of topic k

By estimating topic distributions as described above, the k-dimensional predictive implies the existence of k different leadership behavior tactics for young women.

3.4 Evaluation of the model (PART2)

To evaluate the model, the created prediction model was used training data, and the text data from Data 2 and Data 3 were used as evaluation data. Let D_{train} represent the training data, D_{test} the evaluation data, D the overall data set. γ represents the ratio of training data ($0 < \gamma < 1$), N_{train} the number of training data samples, N_{test} the number of evaluation data samples, and N_{total} the total number of samples in the overall dataset. The dataset is defined as:

$$D = D_{train} \cup D_{test} \quad D_{train} \cap D_{test} = \emptyset \qquad (6)$$

The cosine similarity y_n for each individual N was calculated for each topic k. y_n was determined using the contribution (composition ratio) of the n words that constitute topic k, calculated with the following formula:

$$y_n = CosSim(N,k) = \frac{\sum_{i=1}^{n} x_{ni} \cdot w_{ni}}{|\overline{x_{ni}}||\overline{w_{ni}}|} = \frac{\sum_{i=1}^{n} x_{ni} \cdot w_{ni}}{\sqrt{\sum_{i=1}^{n} x_{ni}{}^2}\sqrt{\sum_{i=1}^{n} w_{ni}{}^2}} \qquad (7)$$

Where:

x_{ni}: contribution of the n words constituting topic k in N
w_{ni}: contribution of the n words in topic k

3.5 Observation of the impact (PART 3 and PART 4)

The short-term impact (PART 3) was observed using data from Survey 3 (Data 3), and the long-term impact (PART 4) was observed using data from Survey 4 (Data 4). If there is a transformation between Data 3 or Data 4 when compared to the validation data from Survey 2 data (Data 2), we can consider that there is an impact on leadership education.

Data2 was collected during the first session of the class, while Data3 was collected during the 15th session. In other words, Data2 and Data3 serve as pre- and post-test analyses to observe the effect of leadership education interventions. The reflect the short-term effect of the education. Data 3 pertains to young workers who have received leadership education, and it will be used to observe how the leadership education they received at university affects them after they enter the workforce. This allows for the examination of the long-term effects of the education.

■4.0 RESULTS AND ANALYSIS

4.1 Basic statistics

The basic statistics from the survey are shown in Table 1.

Table 1 Basic statistics

		Target (People)			Text（word)			
Survey No.	Data Usage	Data collection	Sample	subscriber	Response Rate	Total	Mean	SV
1	Create Model	Class	86	90	.956	41216	479.318	85.965
2	Evaluate Model	Class	105	113	.929	52368	508.427	103.461
3	Observation Short	Class	58	70	.829	22928	377.018	94.865
4	Observation Long	Internet	164	210	.781	11343	65.866	59.938

4.2 Results of Predictive Modelling (PART1)

The text data from Data 1 was analyzed using morphological analysis, resulting in 41216 words. Words with the same meaning or in hiragana were unified into kanji, yielding a total of 1016 vocabulary words. No words had a frequency of 20%, and many words appeared with a frequency of only 1 or 2. Therefore, words with no distinguishing characteristics or high frequency were set as stop words. Specifically, these included nouns like “leadership,” which are not characteristic of this study, nouns frequently used as pronouns or suffixes, and verbs that accompany other words and are used universally.

Numerical indicators of Perplexity and Coherence were then calculated to estimate the topic distribution using LDA (Figure 2). The number of topics, while often set high to capture topics exhaustively, can make interpretation difficult. To efficiently overview the document set, it is important to balance topic diversity and avoid aggregating redundant topics, while also maintaining relevance between l topics. Ultimately, the number of topics should be determined based on ease of interpretation for the analyst (Iwata, 2015).

The number of topics was estimated from numerical indicators. When the number of topics was set to 2 and 3, the diversity of leadership behavior tactics within the topics was considered low. On the other hand, when the number of topics was set to 9 and 12, new

topics emerged that were not present in the 2- or 3-topic models. However, redundant topics also appeared, and the leadership behavior tactics overlapped. Therefore, the final number of topics was set at five. The top 100 words comprising each topic were extracted, and approximately 15 words were used to name each topic (Table 2).

They were named as follows: Topic 1: Competence & Responsibility; Topic 2: Goals & Communication; Topic 3: Leading & Involving; Topic 4: Listening & Concern; Topic 5: Gender Equality. The model was based on a five-dimensional topic distribution.

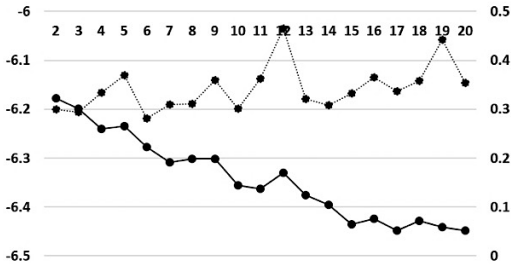

Figure 2 Perplexity and coherence values (* Perplexity: straight lines; Coherence: dotted lines)

Table 2 Models based on five-dimensional topic distributions
(*Top 15 words are listed due to space limitation, *Words specifically cited when naming topics were applied in gray.)

	Topic1		Topic2		Topic3		Topic4		Topic5	
	Competence & Responsibility		Goals & Communication		Leading & Involving		Listening & Concern		Gender Equality	
1	positive	.074	team	.174	around	.300	groups	.184	men	.169
2	partner	.067	members	.163	seek	.104	listen	.098	think	.108
3	group	.060	communication	.147	see	.094	things	.083	all	.097
4	give	.060	goals	.120	environment	.060	say	.080	feel	.064
5	society	.049	important	.064	pull	.050	perspectives	.055	surroundings	.047
6	advance	.039	direction	.052	can do	.050	advance	.049	communicate	.042
7	take	.039	lead	.048	stand	.047	society	.047	strong	.039
8	skills	.037	vision	.030	situation	.035	position	.044	equal	.036
9	responsibility	.035	towards	.030	lead	.035	feeling	.044	make the most	.036
10	situation	.035	ideal	.027	involve	.035	people	.042	ideal	.033
11	purpose	.035	vision	.027	high	.030	fellow	.036	center	.033
12	stand	.033	men and women	.023	keep	.027	turn to	.031	society	.031
13	variety	.028	move	.018	wide	.023	others	.029	myself	.028
14	strength	.028	others	.016	issue	.015	incline	.029	seem	.028
15	atmosphere	.026	position	.014	bring up	.013	flexible	.026	appear	.028

4.3 Evaluation of the model (PART 2) and observations (PARTs 3 and 4)

The cosine similarity between the words comprising the topics and those in Data 2, Data 3, and Data 4 was calculated. A box plot was then created for each group, and the data distribution was observed. The number of samples in each group was used as a weight, and a weighted average was performed. Based on this weight, a modified box-and-whisker diagram was created (Figure 3).

As a result, the overall trend was considered consistent across all datasets. When observed by topic, Topic 1 was significantly higher than the others in all sets. Conversely, Topic 3 and Topic 2 had the lowest scores.

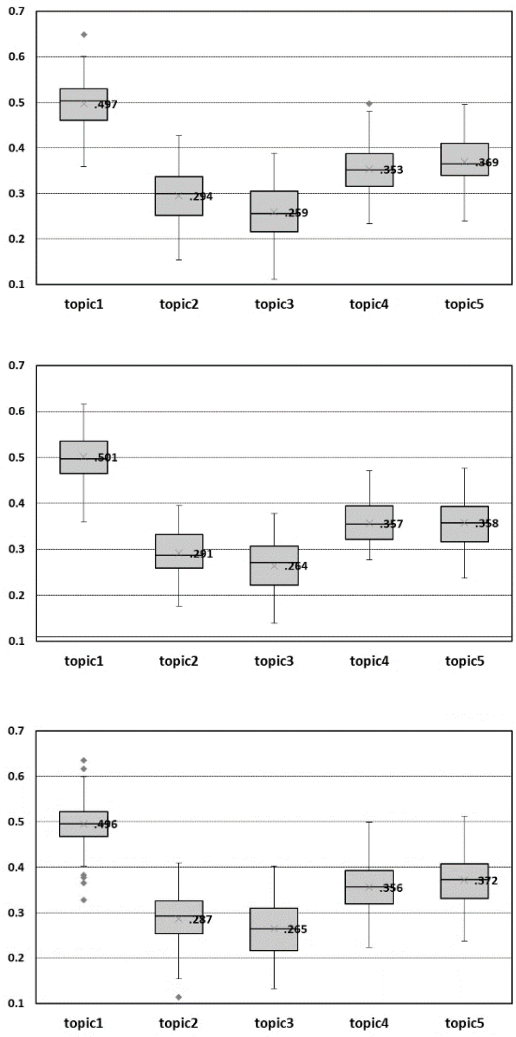

Figure 3 Box plot

(*Data 2 (top): verification, Data 3 (middle): short-term effects of education, Data 4 (bottom): long-term effects of education)

■5.0 CONSIDERATIONS

Regarding the predictive model, the results using Data2 show the same overall trend and can be considered to have explanatory power as a model representing the leadership behavior measures of young women in gender-gap countries.

When comparing Data2 and Data3 to examine the short-term effects of leadership education, it was found that while there was no significant overall improvement, outliers had been eliminated for both topics, the mean had improved slightly, and variability had decreased somewhat. This suggests that the educational intervention was effective, indicating a general trend toward standardization and improvement. However, Topic 1 remained extraordinarily high, while Topic 3 and Topic 2 continued to be low.

In addition, compared to previous studies, it is notable that “Competence & Responsibility” is high, whereas “Leading & Involving” and “Goals & Communication” are low as leadership behaviors for young women in gender-gap countries. Kouzes et al. (2013) and Kouzes et al. (2024) highlight leadership behaviors such as “Navigate Team-Oriented,” “Motivate and Inspire,” and “Enable Others to Act,” while Higano (2015) and Kimura (2019) focus on “Goal sharing” and “Goal Management” as norms for leadership behavior among young adults. The low levels of “Leading & involving” and “Goals & Communication” observed in this study are consistent with previous findings. This supports the role compatibility theory (Eagly, 2003a; 2003b; 2002; 2001; 1990; 1984), which suggests that young women in gender-gap countries still adhere to gender role expectations and view “Leading & Involving” and Goals & Communication” as less prominent leadership behaviors.

Given the recent trend that leadership behaviors can be learned through training and experience, it is essential to provide appropriate education and training for “Leading & Involving” and “Goals & Communication.

■6.0 CONCLUSION

This study aimed to elucidate the impact of leadership behavior education in gender -gap countries, using the case of young women in Tokyo, Japan. It was obtained and analyzed from four data sets from four surveys conducted simultaneously as a research method. First, It be used Data 1 creating a predictive model based on five topics using LDA in topic modeling.

In order to estimate the topic distribution, it be calculated the perplexity and coherence numerical indices, and based on the interpretability by the analyst, it be set the number of topics to five. It be then extracted 100 words that make up each topic. It be named the topics using the top 20 words. Topic 1: Competence & Responsibility; Topic 2: Goals & Communication; Topic 3: Leading & Involvement; Topic 4: Listening & concern; Topic 5: Gender Equality. Next, we used Data 2 to verify the model created using Data 1. Furthermore, we decided to use data 3 and 4 to observe both the short-term and long-term effects of education.

As a result, Data 2, 3, and 4 all showed the same trend, indicating that the model created for the leadership behavior of young women in countries with high gender gap indices could explain the situation well. Topic 1: Competence and responsibility were highly high in Data 2, 3, and 4, and this could be said to be a characteristic of young women's leadership behavior in countries with high gender gap indices. Furthermore, the low scores for Topic 3: Leading and Involving and Topic 2: Goals & Communication suggest the need to foster these behaviors through education.

Further consideration revealed that the effects of leadership education were similar in the short term and the long term, but the long-term effects were more variable. This widening variation can be seen as a difference in individual leadership behavior after they start working. This shows that leadership is part of social behavior. With the above, this research has created a general model of leadership behavior among young women in countries with a gender gap. This model has clarified the characteristics of women in "Oriental countries with a gender gap" and has identified future educational needs. Therefore, this study provided important insights for supporting young women's education, training, and career development in countries with a gender gap.

However, this study's results are limited, and issues remain. The biggest issue is that it is a study of only one country and does not consider attributes, so it lacks generality. In future research, it will be necessary to verify the model created by exploring other groups, such as young men, mature women, and subjects in other gender gap countries and young women in other gender gap countries. It would also be beneficial to verify the results of this research through educational practice at universities. Next, it will be necessary to try other analysis methods and interpretations. In this study, we used LDA for topic modeling, but while the dimensionality reduction made it possible to aggregate and clearly express some features, some features may have become invisible. Therefore, it may be possible to consider using other analysis methods for text mining.

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Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper

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