パス解析を用いた面接審査における影響分析

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和文要旨

　本研究では、AO 入試における面接審査を想定して、パスモデル解析を用いて学生に対する直感評定と成績の間の関係性を分析する。具体的には、ある統計科目における108名の学生（受講生）を対象に、学期の初めに学生に科目の志望理由や意気込みを聞き、それを教員が直感評定した。加えて当該学生の期末成績をとり、この関係性を分析した。また、調査においてはビッグファイブ理論に基づくパーソナリティ特性を日本語版 Ten Item Personality Inventory（TIPI-J）を用いて測定し、パーソナリティ特性と直感評定の関係性を調べた。その結果、面接審査でよく使われる志望理由と意気込みは直接的な関係性はない一方で、意気込みは期末成績と関係性を持つことが示唆された。また、パーソナリティ特性のうち勤勉性（conscientiousness）は意気込みを通して期末成績に影響を及ぼすことも示唆された。

キーワード：直感評定、面接、入学試験、パス解析、ビッグファイブパーソナリティ尺度

An effect analysis of intuitive scoring in interview selections with path model

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I. INTRODUCTION

In this study, we used path model analysis to evaluate the effects between intuitive scoring of students and their academic achievement. Intuitive scoring is a type of evaluation used in the interview selection process to assess candidates' abilities. Although intuitive scoring is often used for university entrance examinations in Japan, its validity has seldom been evaluated. Additionally, the relationship between intuitive scoring and other candidate characteristics, such as personality traits, is also rarely evaluated. In this study, we use path model analysis to evaluate the validity of intuitive scoring and how it relates to personality traits. Intuitive scoring is often used at entrance examination of university in Japan. For example, on the admission office (AO) examination, students are selected by an interview process which includes intuitive

evaluation.

In this study, we examined intuitive scoring for selection interviews (Kahneman, 2011; Gigerenzer & Gaissmaier, 2011) and term-end examination scores as academic achievements for 108 university students. We also measured the Big Five personality traits of these students using the Japanese Version of the Ten-Item Personality Inventory (Gosling et al., 2003; Oshio et al., 2012). Finally, we analyzed the relationship between intuitive scoring, academic achievement, and the Big Five personality traits.

As mentioned before, we examined the relationship between intuitive scoring and the Ten-Item Personality Inventory based on the Big Five personality theory (Tupes & Christal, 1961; John & Srivastava, 1999). The Big Five personality theory (BFPT) is a model based on common language descriptors of personality. The BFPT divides human personality into five traits: Openness to Experience (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N). These traits have been found to be stable across cultures (McCrae and Costa, 1997). A relationship between

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BFPT results and personality disorders (Clark, 2007), anxiety disorders (Kessler et al. 2005), and some other social activities has also been established. Although the best known BFPT scale is the Revised NEO Personality Inventory (NEO PI-R, Costa & McCrae, 1985), it is at times too long to measure when using it along with other psychological scales. To solve this problem, Gosling et al. (2003) developed a shorter scale for the BFPT, the Ten-Item Personality Inventory (TIPI). TIPI consists of ten questionnaires that are easy to use when examining the Big Five traits along with using other scales, such as the IRS tendency scale. For this reason, we chose to use the Japanese version of TIPI for our study.

In this study, we used path model analysis to evaluate the effects between using intuitive scoring for students and their academic achievement. Path models depict the causal relationships between characteristics of interest, and are used to describe quantitative analyses such as regressions, or more complex structural equation models. By using path model analysis, we show the relationship between intuitive scoring and academic achievement and examine if intuitive scoring is able to adequately predict academic achievement.

The remainder of the paper is organized as follows: The experiment design and basic results are presented in Section 2, the results of our analysis are presented in Section 3, and the conclusion and discussion are presented in Section 4.

II. EXPERIMENT DESIGN AND BASIC RESULTS

In this section, we provide a brief overview of our design and results.

A. Participants

A total of 108 undergraduate business majors at a university in Japan participated in this study. From that group, 88 completed this experiment. The participants ranged in age from 18-22 years old. All the participants were enrolled in a statistics course. All the participants were fluent in Japanese. They did not receive any compensation for their participation in this research study.

B. Experiment design

Questionnaires: At the beginning of the semester, we sent the participants two questionnaires. One questionnaire asked about their motivation in joining the statistics course while the other focused on their eagerness.

The Ten-Item Personality Inventory: We used the TIPI to measure the participants' personality traits. As all the participants were fluent in Japanese, we used the Japanese version of the Ten-Item Personality Inventory (TIPI-J) (Oshio et al., 2012). The TIPI-J was administered using a seven-point scale, in accordance with the original studies.

Intuitive scores: Two teachers used intuitive scoring on the two sets of questionnaires (motivation and eagerness). Evaluation criteria

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for scoring was based on if the participants achieved good grades at the end of the semester. The intuitive score was administered using a five-point scale.

Term-end examinations: At the end of the semester, we evaluated the results of participants' final examinations. The final examination consisted of ten items focused on basic statistical knowledge.

C. Data analysis

We used a combination of quantitative and qualitative approaches in the data analysis, which was conducted with respect to the objective set for this study. All analysis was carried out using R statistical software, version 3.3.0.

D. Basic results

From the scales denoted in section II.B, we calculated scale sum scores by each element. The basic statistics for the scale sum scores received from the TIPI-J are shown in Table 1. As mentioned earlier, the table abbreviations represent scale sum scores for Openness to Experience（O）, Conscientiousness（C）, Extraversion（E）, Agreeableness（A）, and Neuroticism（N）. We did not find specific or abnormal values in these statistics. The basic statistics for the intuitive scores and the term-end examination scores are shown in Table 2.

Table 1. Basic TIPI-J statistics

	O	C	E	A	N
Mean	8.236	6.551	7.966	10.191	8.382
SD	2.153	2.384	2.673	2.050	2.556

Table 2. Basic statistics for intuitive scores and term-end examination scores

	Intuitive scores		Term-end examinations
	Motivation	Eagerness	Score
Mean	3.034	3.056	74.438
SD	0.869	0.810	15.345

III. RESULTS OF ANALYSES

A. Analysis 1: Correlation analysis of intuitive scores and related measures

For Analysis 1, we evaluated the correlation between intuitive scores, personality traits, and term-end examination scores in order to analyze them using the path model.

First, we evaluated the correlations within the intuitive scores and the correlation between intuitive scores and term-end examination scores. These results are shown on Tables 3 and 4. Our findings show that motivation and eagerness, which are intuitive scores, have a strong correlation that is statistically significant. On the other hand, for intuitive scoring and term-end examination scores, we only found a mild correlation between eagerness and term-end examination scores. These results suggest that the intuitive score that most affects academic achievement is eagerness.

Table 3. Correlation within intuitive scores

	Eagerness
Motivation	0.813^{***}

Table 4. Correlation between intuitive scores and term-end examination scores

	Eagerness	Motivation
Term-end examination Score	0.226^{*}	0.133

Next, we analyzed the correlation between term-end examination scores and personality traits. These results are shown in Table 5. It is noteworthy that there is no significant correlation between term-end examination scores and personality traits. Although Komarraju et al. (2011) suggested a relationship between academic achievement and personality traits, our findings do not support this. Thus, we did not set a direct relationship between term-end examination scores and personality traits in our later path model analysis.

Table 5. Correlation between term-end examination scores and personality traits

	O	C	E	A	N
Term-end examination Score	0.0935	0.066	0.0037	0.0016	0.0417

Finally, we evaluated the correlation between intuitive scores and personality traits. Table 6 displays these results. Although we concluded that personality traits did not affect term-end examination scores, we found that some personality traits and intuitive scores have a mild correlation. More precisely, personality trait C and eagerness have a significant correlation, and personality trait E and motivation have a marginally significant

correlation. Thus, we established a direct relationship between such personality traits and intuitive scores.

Table 6. Correlation between intuitive scores and personality traits

	O	C	E	A	N
Eagerness	0.1083	0.2152^{*}	0.0542	0.1345	-0.0031
Motivation	0.0656	0.1391	$0.1962+$	0.1431	0.0607

B. Analysis 2: Effect analysis of intuitive scoring using the path model

For Analysis 2, we evaluated the relationship between intuitive scores, personality traits, and term-end examination scores, using the path model based on results of Analysis 1, and clarified factors that affect academic achievement.

We proposed five models, as listed below:

- (Model A) Extended regression model without personality traits. This model describes how eagerness affects term-end examination scores and how motivation affects eagerness. Note that we set causality between motivation and eagerness in addition to causality between eagerness and term-end examination scores.

- (Model B) Extended regression model with personality traits (C). This model describes how eagerness affects term-end examination scores and how personality trait C affects eagerness.

- (Model C) Path analysis model with unidirectional causality. In this model, we set unidirectional causality between motivation and eagerness in addition to causality between eagerness effects and term-end

examination scores, with related personality traits（C, E）.

- （Model D）Path analysis model with bidirectional causality. In this model, we set bidirectional causality between motivation and eagerness in addition to causality between eagerness effects and term-end examination scores, with related personality traits（C, E）.

- （Model E）Path analysis model with correlating errors. In this model, we set correlating errors between motivation and eagerness in addition to causality between eagerness effects and term-end examination scores, with related personality traits（C, E）.

　　As clearly demonstrated, we found that all of these models fit the path model analysis. Thus, we used path analysis with these models.

　　The results of estimation in models A-E are shown in Figures 1-5, and the goodness of fit indices of the proposed models are shown in Table 7. As we found that the basic goodness of fit index（GFI, AGFI, RMSEA, SRMR）exceed the required level, we compared proposed models based on the information criteria index（AIC, BIC）. We found two conclusions. One, Model B is optimal based on the AIC index, and two, Model E is optimal based on the BIC index. The difference between Model B and Model E is the motivation factor of personality trait E. As we found a strong correlation between eagerness and motivation from Analysis 1, we chose Model E to include the motivation factor in our study.

　　Next, we focused on evaluating Model E.

The main characteristics of Models C, D and E are the motivation factor and personality trait E indirectly affecting term-end examination scores. We found unidirectional causality between eagerness and motivation on Model C, bidirectional causality between eagerness and motivation on Model D, and a correlating error between eagerness and motivation on Model E. As a result, we chose Model E. With these results, we suggest the two intuitive scores（eagerness and motivation）have no direct relationship to each other.

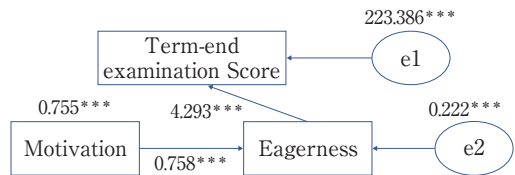Fig. 1. Results of estimation in model A
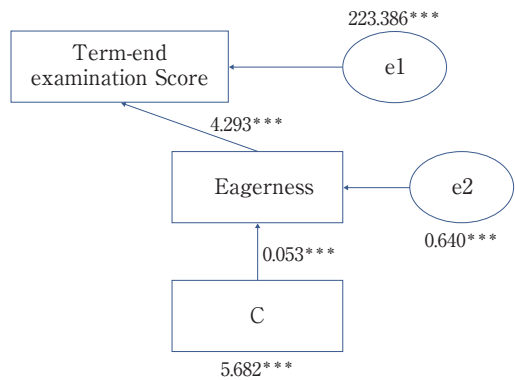

Fig. 2. Results of estimation in model B

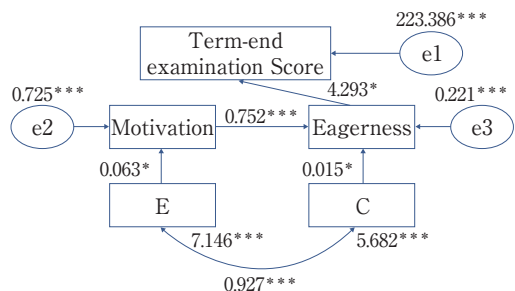Fig. 3. Results of estimation in model C

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Fig. 4. Results of estimation in model D

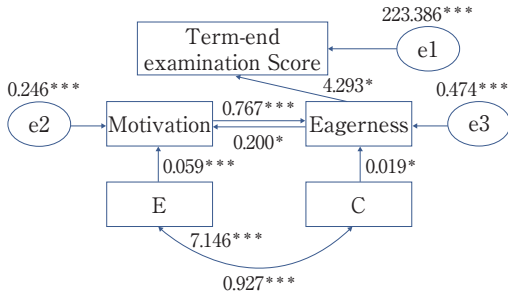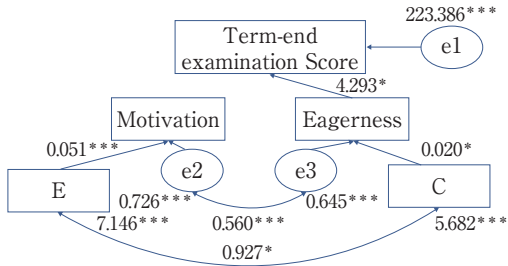Fig. 5. Results of estimation in model E

Table 7. Goodness of fit index of proposed models

	Model A	Model B	Model C	Model D	Model E
GFI	0.994	0.999	0.976	0.992	0.99
AGFI	0.968	0.996	0.93	0.97	0.971
RMSEA	0.000	0.000	0.0250	0.000	0.000
SRMR	0.02	0.021	0.05	0.035	0.046
AIC	10.705	10.087	25.293	23.769	22.161
BIC	−3.784	−4.4	−17.149	−16.185	−20.281

IV. CONCLUSION AND DISCUSSION

In this study, we used path model analysis to evaluate the relationship between intuitive scoring of students and their academic achievement. As a result, we concluded that eagerness and motivation, which are often used in selection interviews, do not have direct causality, and that eagerness affects academic achievement.

These results are very interesting in relation to university entrance examinations. We often evaluate students by their sum scores of eagerness and motivation in the selection interview portion of entrance examinations. However, our conclusion suggests that this evaluation is not appropriate. In future entrance examinations, we should instead evaluate students by eagerness, while viewing motivation as a secondary factor.

We also concluded that the conscientiousness personality trait affects term-end examination scores through eagerness. This means that conscientiousness indirectly affects academic achievement. Conscientiousness is a dimension of getting through work with a certain purpose or intent. Thus, students with a high level of conscientiousness study in an organized, planned way, and these efforts may lead to better academic achievement.

It is interesting that intuitive scoring predicted academic achievement directly, although personality trait using TIPI-J affects academic achievement indirectly. We considered that intuitive scoring evaluated students' detailed characteristics that cannot be measured by TIPI-J.

We also propose two further studies. First, we suggest additional experiments in order to confirm our results for courses other than statistics. In our study, we evaluated intuitive scoring in statistics courses, so we cannot state for certain if intuitive scoring affects all academic achievement, beyond a mathematics-based subject. In the future, we should conduct additional studies with other

courses required for the general university entrance examination, such as foreign language, national language, social science, and science to learn if our results are supported with those courses as well. Additionally, further research is needed to confirm our results are consistent with actual entrance examinations, such as the admission office examination. In this case, we must pay attention to the effects on student selection. As we focus on and assist only successful candidates, we lose group homogeneity, and as such, may not acquire the same results as in this study. More precisely, we may not discern as clear of a relationship between intuitive scoring and academic achievement, as shown in Table 4. We also paid attention to personality traits. As Komarraju et al. (2011) suggested, the relationship between personality traits and academic achievement may reduce the goodness of fit index of a path model, such as in Table 7. In actual observations of entrance examinations, it is preferable to observe both rejected and accepted candidates. However, this experimental design may be hard to apply, as we do not typically follow rejected candidates.

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Abstract

In this study, we used a path model analysis to evaluate the effects between intuitive scoring of students and their academic achievement. More precisely, we examined intuitive scoring for interview selection and term-end examination scores as it relates to academic achievement for 108 university students. We also used the Japanese Version of the Ten-Item Personality Inventory to measure the Big Five personality traits of the students. Finally, we analyzed the relationship between intuitive scoring, academic achievement, and the Big Five personality traits. As a result, we concluded that eagerness and motivation, which are often used in interview selections, do not have direct causality, although eagerness does affect academic achievement. We also concluded that the conscientiousness personality trait affects term-end examinations through eagerness.

Keywords : intuitive selection, interview, entrance examination, path analysis, Big Five personality traits.