

# A Statistical Interpretation of The Learners' Input, Intake and Output in Two Communicative Tasks Through Structural Equation Modeling (SEM)

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**Abstract:** This paper presents a defined framework of the notion of "communicative task" and observes, in statistical terms (SEM and t-test), how 140 university students go through the process of "input", "intake" and "output" in performing two communicative tasks, i.e., to participate in group discussion, and to write a post-meeting notice, as required. Findings show that the activities of "input-intake-output" are interrelated with each other such as: similar level of complexity in "input" may have significant differences in "output" performance; it is the "intake" that forms the basis for "output"; however, there are unexpected discrepancies between "intake" and "output", and the like. Findings also confirm the validity of the framework as proposed for this study, and most of all, the employment of SEM proves to be a useful device in describing the complexity of communicative task for higher level of objectivity.

Key words: communication task, input-intake-output, structural equation modeling (SEM)

## 1. Academic Basis

The study involves two research issues for inquiry: (1) the notion of "communication task", (2) the performance process of "input-intake-output". An understanding of the conceptual frameworks of (1) and (2) is presented as follows.

## 1.1 The Notion of Communicative Task

A task can be viewed as a structural activity or work plan for attaining specific objective in various forms of outcome (Crookes, 1986; Bygate, Skehan, & Swain: 2001). In thinking of human communication, we take the definition of communication task, an activity that calls for meaning-focused language use to attend certain communicative function(s) for fulfillment of an intended goal in world-situated practice. The activity is a dynamic social interactive process with 6 multi-facet features, namely: (1) work plan, (2) form/genre, (3) real-world processes of language use, (4) language skills, (5) cognitive processes, and the intended (6) communicative outcome (Ellis, 2003, pp. 1–10).

## 1.2 The Input-Intake-Output Process

## 1.2.1 The Input

Before taking any real act to communicate, in most cases, there is a communicative need with some kinds of resource, mental or materials, verbal or non-verbal, to be referred to as a directive force for real action. Such "given information" is the "input" of the task in a broad sense. As communication tasks are in vast varieties, an

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"input" of a task would inevitably touch the question of what makes an input more easy/difficult than that of another, i.e., the issue of input complexity which is suggested to be observed by Ellis (2003, pp. 222–224) in 5 aspects: (1) "input medium", (2) "code complexity", (3) "cognitive complexity", (4) "context dependency", (5) "familiarity of information".

## 1.2.2 The Intake

It is a simple fact that a given information or instruction of a communication task to a learner/student for action, does not necessarily qualify it for the status of "input", for the reason that input is what goes in, rather than what is available for going in. In this sense, it is the learner/student who really controls this input, which is his/her "intake", which is concerned with "linguistic intake" and "intuitive intake" in the process of interaction between the learner/student and given information (Corder, 1981, pp. 58–59).

## 1.2.3 The Output

For the notion of "output", the study focuses on "product outcome" which can be evaluated in terms of (1) linguistic presentation, which includes the levels of vocabulary, sentence structure, verbal/textual presentation; and (2) the fulfillment of communication, which can be evaluated in terms of completeness, appropriateness, and function (Gumperz, 1986, pp. 14–23; Hymes, 1986, pp. 35–71).

For the levels of vocabulary and sentence, and textual presentation, the criteria of judgement are (1a) native speakers' linguistic intuition, (1b) explicitness of message, and (c) creativity of sentence production.

For the fulfillment of communication, the criteria of judgement are: (2a) "Completeness", which refers to the organization of ideas as presented among units of paragraph/sections of a text (Imhoof M. & Hudson H., 1980) or the thread of getting started and keeping going in a conversation (Wardhaugh R., 1989); (2b) appropriateness, which has been discussed within the concept of language attitude (Saville-Troike, 1989, pp. 181–219) and can be observed from the aspects of referential appropriateness, social appropriateness, stylistic appropriateness, and textual appropriateness (Corder, 1982, pp. 82–106); and (2c) language function that has been identified by Jakobson (1960, pp. 353–357) in 6 subtypes, namely, "referential function", "emotive function", "conative function", "phatic function", "metalingual function", "poetic function".

From the above discussion, a hierarchy of parameters concerning the notions of input-intake-output is built:

Higher order variable	parameter
	input medium
	code complexity
Input	cognitive complexity
	context dependency
	familiarity of information
	linguistic data
	intuitional data
Output	grammatical judgement
	completeness
	appropriateness
	function

 Table 1
 Hierarchy of Parameters Among "Input", "Intake", and "Output"

# 2. Methodology

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The methodology includes (1) statistical description of task complexity in the structure of SEM; (2) collection of data of communicative task.

## 2.1 SEM Analysis

The study adopts inferential statistics, in particular, the statistical theory and method of "Structural Equation Modelling" (SEM) (Duncan, Duncan, Strycker, Li, & Alpert, 1999) for observation. SEM is a powerful statistical model for multivariate analysis, and is widely used by researchers to examine authentic phenomena that involve multiple variables with complex patterns of interaction.

And a local matrix of correlations among parameters in the notions "input", "intake" and "output" can be achieved through SEM. By such operation, the correlations among each set of parameters in the notions of "input", "intake" and "output" can also be shown respectively, and as the relations develop, an overall model about the interaction pattern between the process of "intake" and "output" under certain "input" will be obtained.

#### 2.2 Collection of Data

As a pilot project, this study will confine itself to two communicative tasks, one spoken and one written, which are tasks used for continuous assessments of the university-wide compulsory Chinese subject "Fundamentals of Chinese Communication" (CBS1101P), which is part of General University Requirement (UGR) of the Hong Kong Polytechnic University (PolyU). The tasks are:

- 1) Group discussion (spoken)
- 2) Post-meeting notice (written)

140 undergraduate students who took part in the project were selected from major faculties of PolyU including, the Faculty of Health and Social Sciences, the Faculty of Business, the School of Hotel and Tourism Management, the Faculty of Applied Science and Textiles, the Faculty of Construction and Environment and the Faculty of Engineering, forming a sample with balanced composition of students of different disciplines.

## **3. Findings and Discussion**

#### 3.1 The Input

(The instruction of written assignment)

Before conducting this task, students were given newspaper reports and video clips on a disputed case of property owners and the developer. Further information was given on the developer's proposals of settlement. Students were required to play the role of property owners and have an emergency meeting (i.e., group discussion) regarding how to respond to the offer. Afterward, students were asked to write individually a post-meeting notice to all owners of the concerned property, including the absentees, to notify them about the consensus made in the meeting as well as further actions (if any) to be taken.

3.1.1 Post-Meeting Notice (Written Task)

By applying the framework mentioned in 1.2.1, the complexity of the input concerned is analyzed as follows:

- 1) "input medium": With regard to the presentation of information, the input included multimedia sources, therefore the input medium is regarded complex;
- 2) "code complexity": In terms of lexical density and syntactical complexity, the input is deemed with general degree of complexity, as most of the input was taken from news reports aiming at the general

public;

- 3) "cognitive complexity": Having considered (a) the dimensions of information type in terms of static and dynamic, and (b) the amount of information to be processed, and (c) the degree of structure of the input, the input of this task is treated complex since the information is dynamic, with a large amount and with multifaceted input structure;
- 4) "context dependency": In regard to the contextual support to the task, it is considered to be highly context dependent as its content is wholly based on the result of group discussion;
- 5) "familiarity of information", i.e., the relationship between the theme of the task and the individual learner's world knowledge: the input is deemed to have a medium degree unfamiliarity to the learner as many of the students may not have experience of real property purchase.

3.1.2 Group Discussion (Spoken Task)

The complexity of the input concerned is analyzed as follows:

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- 5) "familiarity of information", i.e., the relationship between the theme of the task and the individual learner's world knowledge: the input is deemed have a medium degree unfamiliarity to the learner as many of the students may not have experience of real property purchase.

# 3.2 The Intake

3.2.1 Post-Meeting Notice (Written Task)

To understand learners' intake, i.e., the dynamic process of interaction between the learner/student and the input, a questionnaire was distributed to students and they were required to fill it out after reading or watching the input and before writing up the post-meeting notice.

The questionnaire is composed of six questions with different statements. Students have to express to what extent they agree with the statements in Likert-based scales. Following the framework proposed in 1.2.2, they are supposed to be grouped into two main factors:

- (1) "Intuitive intake", which refers to the learner's/student's retrieval of his/her own knowledge of intuitive judgement:
- Q1: On students' judgement on the goal of the concerned communicative task;
- Q4: On students' judgement on the functions of the concerned communicative task;
- Q5: On students' judgement on the complexity of the input.

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- (2) "Linguistic intake", which relates directly to the language of the given information:
- Q2: On students' understanding of how to prepare and compose a post-meeting notice;
- Q3: On students' understanding of the detailed content to be included in the notice;
- Q6: On students' understanding of the focus points of the notice.

3.2.2 Group Discussion (Spoken Task)

By the same token, a questionnaire was distributed to students and they were required to fill it out after reading or watching the input and before conducting group discussion.

The questionnaire is composed of seven questions with different statements. Students have to express to what extent they agree with the statements in Likert-based scales. Following the above-mentioned framework, they are supposed to be grouped into two main factors, where Q7 belongs to both:

- (1) "Intuitive intake", which refers to the learner's/student's retrieval of his/her own knowledge of intuitive judgement:
- Q1: On students' judgement on the goal of the concerned communicative task;
- Q4: On students' judgement on the functions of the concerned communicative task;
- Q5: On students' judgement on the complexity of the input;
- Q7: On students' judgement on and understanding of concluding a discussion properly.
- (2) "Linguistic intake", which relates directly to the language of the given information:
- Q2: On students' understanding of how to prepare and conduct a group discussion;
- Q3: On students' understanding of the detailed content to be included in the discussion;
- Q6: On students' understanding of turn-taking with politeness;
- Q7: On students' judgement on and understanding of concluding a discussion properly.

#### 3.3 The Output

3.3.1 Post-Meeting Notice (Written Task)

The output refers to the product outcome made by the learners. Students were asked to write up a post-meeting notice individually. Each piece of students' work was marked by two experienced language teachers. The two sets of scores were merged into one set for statistical analysis.

3.3.2 Group Discussion (Spoken Task)

Students were divided into groups of 3 to 6 and conduct discussion. Each group was videotaped and marked by two experienced language teachers. The two sets of scores were merged into one set for statistical analysis.

The marking criteria is common for both task and they were selected on the basis of the framework mentioned in  $1.2.3^{1}$ .

## **3.4 Statistical Analysis**

The purpose of having statistical analysis is to obtain an objective basis for data interpretation, which includes (a) "input vs intake", (b) "input vs output", (c) "correlation between internal factors in output", and (d) "the relation between intake and output". (a) and (b) are calculated by t-test; (c) and (d) are worked out through Structural Equation Modelling (SEM).

#### Table 2 The Marking Criteria for "Output"

<sup>&</sup>lt;sup>1</sup> The variables "referential" and "stylistic" under the category "appropriateness" as well as "poetic" and "metalingual" under the category "function" are deemed irrelevant to the present task and thus excluded in the analysis of this section.

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Parameters	Items	Variable name
	Rules	X1
1. Grammatical judgement	Message	X2
	Creativity	X3
	Cohesion	X4
2. Completeness	Coherence	X5
	Stand-alone	X6
2 Americanistances	Social	X7
5. Appropriateness	Textual	X8
	Referential	X9
4 Expertion	Emotive	X10
4. Function	Conative	X11
	Phatic	X12

## 3.4.1 T-test

(1) T-test — "Input vs Intake"

T-test is a procedure for determining whether the different between two means is statistically significant. From the surface understanding of the input features of the tasks of "post-meeting notice" and "group discussion", they are of similar level of complexity and requirement (cf. 1.2.1, 3.1.1 and 3.1.2). What really means of a task input can only be reflected in the subjects' intake, that is the way it is interpreted by The subjects both intuitively and linguistically (cf. 1.2.2). And the effects of the input of different tasks on students would better be observed in a contrast manner. Therefore, the means of intakes from respective inputs of "post-meeting notice" and "group discussion" are calculated in t-test for statistical significance as shown in Table 3.

	Post-meeting notice	Group discussion	<i>p</i> -value
Intuitive intake	3.30	3.58	0.003**
Linguistic intake	3.25	3.41	0.097

 Table 3
 Means and T-test Results (Two Tails) for Intake of Different Inputs (N = 140)

\*\* p < 0.01 (highly significant)

It is found that the "intuitive intake" of post-meeting notice (mean: 3.30) and that (mean: 3.58) of group discussion are significantly different (p-0.003), indicating that the effects of input of these two tasks on the subjects are highly different in their judgement of task goal, task function, and task complexity. On the other hand, the students seem to know well about how to write a notice, and how to participate in group discussion. In this aspect, i.e., the differences of their "linguistic intake" of the two tasks, are less significant (p-0.097).

(2) T-test — "Output vs Input"

In the same vein, it is useful to compare the outputs of the two tasks, which are the results or products directed by each of the inputs of its specific task separately. Results from t-test operation are shown in Table 4.

#### Table 4 Means and T-test Results (Two Tails) for Output of Different Inputs (N = 140)

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	Post-meeting notice	Group discussion	<i>p</i> -value
Grammatical judgement	3.33	4.28	0.000**
Completeness	3.64	4.20	$0.000^{**}$
Appropriateness	3.55	4.40	$0.000^{**}$
Function	1.96	2.07	0.2262

\*\* p < 0.01 (highly significant)

From the table, we can see that while being asked to write a "post-meeting notice" and to participate in "group discussion" which are of similar level of complexity in input features, the students' outputs in these two tasks are significantly different in the aspects of "grammatical judgement" (p-0.000), "completeness" (p-0.000), and "appropriateness" (p-0.000), but their outputs are insignificant in task function (p-0.2262).

Generally speaking, verbal discussion is conducted in spoken mode, whereas writing a notice is in written mode. There is no surprise to see that they differ from each other significantly. At closer look, the students are fully aware of the underlying principles in writing a notice, i.e., its linguistic requirements such as language fluency, clarity of message, creativity in sentence production, text cohesion and coherence, as well as social and textual appropriateness. On the other hand, when being asked to join in "group discussion", they can also cope with the different requirements in spoken performance. All these key factors are fully aware of by students while performing these two tasks respectively. Thus, they give distinct performances for these two tasks in terms of grammar, completeness, and appropriateness. As for task functions, which is more concerned with communication effect than with individual production processes. When both outcomes are satisfactory in practice, they are of similar function in terms of task fulfillment.

3.4.2 SEM Analysis

(1) Post-Meeting Notice (Written Task)

To examine the suitability of the application of the intake-output theoretical framework to the observed data, a CFA operation has been conducted under the SEM technique by LISREL. And the results are as follows:



Figure 1 LISREL Estimates (Maximum Likelihood, Number of Iterations = 50, N = 140)

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Table 5Goodness-of-Fit Statistics (N = 14)	0)
Degrees of Freedom for (C1)-(C2)	127
Maximum Likelihood Ratio Chi-Square (C1)	358.259 (P = 0.0000)
Root Mean Square Error of Approximation (RMSEA)	0.114
Non-Normed Fit Index (NNFI)	0.837
Comparative Fit Index (CFI)	0.865

Table 5 provides an overview of fit indices for different factor solutions within CFA. All the fit indices show support to the proposed modified theoretical framework on intake analysis. The result suggests that the hypothesized model by and large fits the observed data.

In Figure 1, there are two latent variables for "intake", namely "intuitive intake (II)" and "linguistic intake (LI)", and four latent variables for "output", namely "grammatical judgement (GRAM)", "completeness (COMP)", "appropriateness (APPR)" and "function (FUNC)". Each of them is measured with several observed variables (i.e., items for questionnaire and scoring).

The diagram reveals that most observed variable has a considerable contribution to the latent variables they supposed to belong to, whose factor loading ranges from 0.47 to 0.92. It is also found that Q1 and Q2 correlate each other, because both questions are about the students' self-evaluation on their mastery of the task requirements.

The latent variables themselves have high correlation with 'intake' and 'output' respectively. However, the correlation index between "intake" and "output" is relatively low (0.29), showing that there is a discrepancy between students' intake and their output in doing this task. It suggests that although students may be able to judge and understand the key requirements of the communicative task, many of them failed to apply them to their product.

(2) Group Discussion (Spoken Task)

To examine the suitability of the application of the theoretical framework to the observed data, a CFA operation has been conducted under the SEM technique by LISREL. And the results are as follows:



Figure 2 LISREL Estimates (Maximum Likelihood, Number of Iterations = 50, N = 140)

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Table 6         Goodness-of-Fit Statistics (N = 14)	0)
Degrees of Freedom for (C1)-(C2)	141
Maximum Likelihood Ratio Chi-Square (C1)	308.684 (P = 0.0000)
Root Mean Square Error of Approximation (RMSEA)	0.0918
Non-Normed Fit Index (NNFI)	0.860
Comparative Fit Index (CFI)	0.884

Table 6 provides an overview of fit indices for different factor solutions within CFA. All the fit indices show support to the proposed modified theoretical framework on intake analysis. The result suggests that the hypothesized model by and large fits the observed data.

In Figure 2, there are two latent variables for "intake", namely "intuitive intake (II)" and "linguistic intake (LI)", and four latent variables for "output", namely "grammatical judgement (GRAM)", "completeness (COMP)", "appropriateness (APPR)" and "function (FUNC)". Each of them is measured with several observed variables (i.e., items for questionnaire and scoring).

The diagram reveals that the observed variables' contribution to the latent variables they supposed to belong to varies from 0.20 to 2.21. The one with the lowest factor loading, namely Q7 to LI, is understandable as it is at the same time serves to account for II (with a factor loading of 0.84).

It is also found that Q6 and Q7 correlates each other, because both questions are about the students' judgment on the appropriate ways of expressions for group discussion purposes. For the output side, it is noted that "message" (X02) negatively correlates with both "social appropriateness" (X07) and "emotive function" (X10) slightly. "Message" is about the message to be explicit, i.e., it must not leave anything (too much information) unstated for the reader/interlocutor to fill in from his/her own knowledge. It is, however, somehow contradicts with "social appropriateness" and "emotive function" in the case of face-to-face spoken communication — being too frank or explicit may be regarded rude and emotional.

The latent variables themselves have high correlation with "intake" and "output" respectively. However, the correlation index between "intake" and "output" is extremely low (0.06), showing that there is a large discrepancy between students' intake and their output. It suggests that although students may be able to judge and understand the key requirements of the communicative task, most of them failed to apply them to their product.

## 4. Suggestions and Conclusion

The findings indicate two significant points about the students' performance in the process of "input – intake – output".

(1) At the level of genre, from the t-test of "input vs intake" (cf. 3.4.1), it is obvious that students know well about the conventional requirements between writing a notice and taking part in a discussion, both intuitively and linguistically. And they can distinguish these 2 genres quite clearly in their products (cf. 3.4.2).

(2) At the level of presenting their understanding of these two genres linguistically, there are great discrepancies between students' intake and output in both tasks, in which the discrepancy of the spoken task (cf. 3.4.2.2) is greater than that of the written one (cf.3.4.2.1). As far as the written task is concerned, both the intake and the output were made in written form, while for the spoken task, the intake was done in written form and the output in spoken (Putonghua) form. As most of the students are local students whose mother tongue are Cantonese rather than Putonghua, it may somehow hindered students' application of their intake to the output in-group

discussion.

The findings also reveal that the teaching contents, which may be regarded input in the broad sense, function to build up students' intake – they are able to understand the requirements of a communicative task, but the bridging between the intake side and the output side has to be strengthened.

To conclude, by the application of SEM analysis, the correlations among each set of parameters in intake and output have been shown, and the overall model to analyze the complexity of communicative tasks has been proposed and confirmed by observed data. Task complexity is by nature, a qualitative notion, which carries its implication more in practice than in theory. The study has made an attempt to quantify its practice sense by means of a statistical model.

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