

# Correlations between task complexity and measures of language development in the foreign language classroom

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*Does the Cognition Hypothesis predict the correlation between task complexity and language development? Robinson (2003) proposes that by increasing the cognitive demands in tasks, language learners will produce more fluent, accurate and structurally complex language. In a longitudinal study, a 10<sup>th</sup> grade class follows a syllabus designed to increase cognitive demands. The class ranks higher in fluency and structural complexity measurements in both the spoken and written data, but do not improve in accuracy. This study investigates how the complexities of tasks in the classroom are realized in the classroom and how they are related to language development.*

## Introduction

In Waara (2009), young learners show improvement in fluency when their teachers are aware of planning time in their English lesson design. Teachers experience increased motivation and enthusiasm from their learners when they give learners the opportunity to think about what they were going to say. In Waara (2010), upper secondary students in German and Spanish classes show improvement in accuracy, complexity and fluency when their teachers are aware of providing language input. Tasks that contain higher cognitive demands are identified as a contributing factor to improvements in accuracy. Both of these previous studies are conducted over relatively short time periods, 10 lessons and 16 lessons respectively. The current study is considerably longer and spans 8 months and includes approximately 70 lessons. The syllabus is designed within a task-based learning framework with the intention to increase cognitive demands and meet the motivational challenges of the classroom.

## Study background

Lessons are designed using basic principles of task-based learning that includes a pre-task phase, a task-cycle phase that emulates real world communication in terms of preparation and reporting, and a language focus phase as discussed in Willis (1996). Each component reflects a central aspect of language acquisition. The pre-task prepares learners for a task-cycle by providing necessary words and phrases. In other words, learners are equipped for the main part of their lesson, i.e. task-cycle, with relevant input. Following the pre-task component, the task-cycle creates a context in which the lear-

ners use the target language to achieve a communication purpose or goal. Emphasis is placed on the exchange of meanings, in as close as possible to real-world communication situations as possible, with no focus on specific language forms. Examples of types of tasks include making lists, unscrambling a story, making a poster, and negotiating a map. The cognitive complexity of a task can be adjusted based on the age and skill level of the learners. The last part of the task-cycle is called 'going public' and is meant to encourage learners to prepare their presentations with an eye on accuracy. Following the task-cycle, the language focus phase is intended to capture aspects of language that learners struggle with during the task-cycle. The language focus component stimulates learner awareness in which noticing and discovering how language works are central notions. The teacher plays a central role in capturing what the learners need at this final stage. In this study, the task that is being investigated is the task in the task-cycle.

Robinson (2003) distinguishes between two categories of dimensions of task complexity, a *resource-dispersing* dimension and a *resource-directing* dimension. The *resource-dispersing* dimension, also referred to as the performative dimension, is described the degree of planning time or thinking time allotted, the level of prior knowledge and whether or not the task has a single step or multiple steps. The resource-dispersing dimension does not provide learners with any bits of language or 'language code' to complete the task, rather it refers to the amount of planning time allotted the pupil during preparation of a task or the amount of planning time during task presentation. The status of prior knowledge for any given task will affect attentional resources to solving the task. While some tasks are a single step in the sense that a pupil's attention can fully be given to one task such as make a list. Other tasks are more complicated and consist of multiple steps such as make a list on which you and your partner agree. Robinson proposes that the resource-dispersing dimension is not attributed to language development, but describes the nature of access to already existing target language (L2) knowledge. Increasing complexity or dispersing attentional resources more extensively, along the resource-dispersing dimension simulates the processing conditions of real-time language. Therefore stimulating real-time access to the learner's repertoire of language should lead to increased fluency in learner production.

The *resource-directing* dimension, also referred to as the developmental dimension, is described in terms of how many elements are needed to conduct the task, whether or not reasoning is necessary, and if the task occurs in the present or in a more abstract setting in the past. Tasks that involve fewer elements that are given or readily accessible seen from the pupil's perspective are less complex, whereas tasks that require the pupil to take multiple perspectives are more complex. Tasks that involve transmission of facts and no reasoning are less complex than tasks that require a pupil to support interpretations by giving reasons. Tasks that require a pupil to reason about other people's intentions and beliefs are examples of cognitively complex tasks. Tasks involving the immediate present are less cognitively complex than tasks involving absent objects.

Robinson attributes language development to increases in task complexity along the *resource-directing* dimension because it directs learners to particular aspects of language code. One of Robinson's claims in the Cognition Hypothesis is that by increasing the cognitive demands of tasks, the learner will be pushed to 'greater accuracy

and complexity of L2 production in order to meet the consequently greater functional/communicate demands they place on the learner' (2003, p. 45). The cognitive demands of the task require the learner to discover the language they need to complete the task. Therefore, increasing the cognitive complexity of tasks should lead to increased accuracy and complexity in the learner production.

#### **Study question**

Does increasing cognitive complexity lead to increased fluency, accuracy and structural complexity in learner production?

#### **Project design and material**

Two classes of 10<sup>th</sup> graders from different schools are selected for the project. Lessons for the experimental group are designed following principles of task-based learning over an 8-month period. Lessons for the traditional class are designed primarily following a standard textbook.

The material used to look at task complexity includes reports from the teachers at the end of the year, lesson plans for approximately 70 lessons and interviews with teachers. The pre-tests and post-tests used to measure language development include a written narrative, vocabulary test, and a spoken narrative that is based on picture series.

The pupils are recorded at the beginning of the school year and at the end, approximately 8 months. During the recording procedure, pupils are given as much time as they want to prepare their stories, and any questions they have about content or clarification of the pictures is provided before their stories are recorded. The idea is that planning time should not be a hindrance, and that pupils are free to show their learner language production.

The material is transcribed. Pauses are indicated in the transcripts with periods for complete breaks marked by falling intonation, commas indicate a shorter break and then the speaker continues an utterance, and three dots indicate a perceptible break. These phenomena are used in identifying AS-units (defined below in this section). Procedures for data collection and analysis are adapted from Gilabert (2005).

Speech production is measured in terms of fluency, structural complexity, and accuracy. The calculations are described in detail. Pruned speech is used to measure fluency and is calculated by counting the number of syllables and dividing by the total number of seconds and multiplying by 60. Repetitions, self-corrections, false starts, and comments in Norwegian are excluded. Structural complexity is basically the ability to put more than one constituent together in a meaningful way. In other words, when coordination or subordination is put together such that the bits have meaning, then there is a level of complexity. False starts, repetition, corrections, are not counted as AS-units in this calculation.

The measure used for calculating structural complexity is the number of clauses divided by the number of Analysis of Speech Units (AS-units). AS-units are described in Foster, Tonkyn & Wigglesworth, (2000, p. 365) as 'a single speaker's utterance consisting of *an independent clause, or sub-clausal unit, together with any subordinate clause(s) associated with either.*' AS-units are chosen because they best are able

to deal with features characteristic of spoken data, such as intonation and pauses. A clause is defined as a finite or non-finite verb plus one additional clause element. The measures used for calculating accuracy are error free AS-units, and ratio of errors to words.

The number of occurrences of self-repairs is counted. Self-repairs tell us something about the monitoring the pupil does during speaking. Self repairs are considered a measure of accuracy because they denote attention to form and an attempt at being accurate (Gilabert, 2007).

The written material is a short narrative for which the pupils have 15 minutes to write. Accuracy is measured by dividing the number of T-units by the number of T-units with no errors. A T-unit is indicated by a full stop and contains a verb. Lexical, morphological and syntactic errors are counted and marked. Structural complexity is measured by dividing the number of T-unit by the number of T-units containing more than one verb.

Vocabulary is measured with using a multiple choice test in which one word is given outside a box containing 8 words. The pupil must select the 4 words that go together with the given word.

The results of the pre-tests and post-tests are compared for each pupil and if the post-test has a higher score, this is counted as improvement.

## Data presentation and discussion

### *Comparing task complexity between traditional class and task-based learning class*

Using the lesson plans and interviews with teachers, tasks are categorized using Robinson's divisions for resource-directing and resource-dispersing dimensions of complexity.

The traditional class follows the textbook, cover to cover, and supplemented with extra material such as additional factual texts, grammar exercises, and information on grammar. There is a marked focus on correct pronunciation. A generous number of reference books on grammar and grammar exercises, internet texts are incorporated into the lessons by the teacher.

The task-based learning class lessons are designed following task-based learning principles. Teaching is planned in blocks of about 6 weeks at a time, with weekly discussions about progress and necessary adjustments. Each block of teaching has clear learning goals from the national curriculum. Three youth novels, audio material, and additional activities, such as transitional activities between blocks of teaching are used. In the end of the year teacher report, two references are reported, Ellis (2003) and Willis (1996), as well as an outline of the task-based learning framework.

### *Comparison of activities and tasks*

In the traditional class, the main activity that is done in the classroom is referred to as activity and this is compared to the main task that is part of the task-cycle in the task-based learning class. Based on the lesson plans and teacher interview the following types of activities are identified as frequently used with the traditional class:

- Textbook text: Read out loud, discuss vocabulary list, answer questions and discussion
- Teacher controlled blackboard teaching
- Discussion based on films and a novel with questions
- Book project, read out loud, approximately 6 weeks
- Words and phrases exercises
- Listening activities with CD, discussion and pronunciation focus
- Short writing activities
- Grammar exercises and presentation through handouts

Types of tasks in the task-based learning class:

- Group work
- Vocabulary building tasks
- Journal writing, feedback and dialog with teacher weekly
- Current events reports
- Strategy awareness
- Arguments for and against
- Listening tasks
- Short writing tasks

Both classes are provided with generous input of written and spoken language, but in rather different ways. In general, the traditional class is provided with extra factual material as an additional source of input to the textbook. Specifically, the traditional class focuses on vocabulary lists in connection with reading a text which are gone through prior to reading the text or that are used as an aid during the reading process. In the task-based learning class, vocabulary that is necessary for completing the task is presented in the pre-task cycle. In other words, the tools are provided in a context that prepares learners for the main task. Glossary lists are not used in the task-based learning class.

In the traditional class, approximately one third of the lessons are dedicated to work on grammar. Grammar is viewed by the teacher as meta-awareness, and involves looking at language as a system. The material is taken from textbook, workbook and extra material that the teacher has collected. In addition, the teacher provides extra information and exercises based on what the teacher observes as problematic for the learners. The grammar work is not connected to the text directly or based on what the learners need at the time to understand the text or to produce text.

In the task-based learning class, grammar is not addressed as something outside of understanding English. In other words, grammar activities are not used in class teaching, but when a learner struggles with comprehension or production, grammar is referred to and explanations are given on an individual level, using the 'need to know principle'. The language focus activities focus on strategies, models, and noticing. Within the task-based framework, the language focus activity is intended to capture areas that learners struggle with during the main task.

Correct pronunciation is emphasized by the teacher in the traditional class, while in the task-based learning class pronunciation is only emphasized when it impedes

communication. The task-based learning class are given many different arenas for language production in which communication or the exchange of meanings is emphasized, e.g. as part of task cycle, in current event reports, and journal writing.

The task-based learning class are allowed and encouraged to use time to plan their responses as part of the task-cycle. This includes when they are planning their tasks for reporting to others and as they are presenting their reports. Prior knowledge of the topic and relevant vocabulary and phrases are introduced in the pre-task. Tasks are always done in groups or pairs such that negotiation is a central element. Consequently, the simple task of making a list requires a level of negotiation and is therefore considered to involve multiple steps because the group must agree what to write down. Group and class discussions are also considered to involve multiple steps.

In the traditional class there is no focus on planning time or any explicit attention to allowing planning time. Most often discussions are a real-time product. Prior knowledge of the topic is in many cases based on the individual learner's use of homework, but is difficult to assess in this study. The activities based on textbook are in most cases single step because there is no negotiation.

The task-based learning class is often times faced with multiple perspectives such as reasoning and justifying from another person's perspective, which are considered to be cognitively demanding. Many tasks require the learners to use 'there-and-then' perspective with reference to abstract concepts.

The traditional class is faced with multiple perspectives in their teacher facilitated discussions. In terms of reasoning, the traditional class has more 'fact transmission' activity types, i.e. answer questions about texts. However, in discussions they are required to discuss their own opinions, which go beyond 'fact transmission'. The activities in general tend to be more in the present, i.e. 'here-and-now'.

Based on the teacher interviews and the types of activities and tasks most frequently used in the two classes some patterns emerge. The distribution between the resource-dispersing dimension and the resource-directing dimension are summarized in Table 1.

	Task-based learning class	Traditional class
	Low	High
Resource-dispersing	+planning	-planning
	+prior knowledge	-prior knowledge
	-single step	±single step
	High	Low
Resource-directing	+many elements	+ few elements
	+reasoning	+ no reasoning
	+there-and-then	+ here-and-now

Table 1: Summary of classes along dimensions

The resource-dispersing dimension is given in the first row. The complexity of the resource-dispersing dimension is considered to be lower when learners are provided with planning time as indicated with '+planning'. When no planning time is provided the complexity of the resource-dispersing dimension is higher, as indicated with '-planning'. In the real-world, planning time is minimal and therefore by limiting planning time to language learners we approximate real-world conditions. The two classes differ on this aspect as listed in Table 1. Accessibility to prior knowledge differs in the same pattern. The tasks that the task-based class has done during the 70 lesson period are less complex in terms of approximating real-world situations than the traditional class. With respect to planning time and prior knowledge, the two classes are at the opposite ends of the resource-dispersing dimension. However, the two classes differ slightly with respect to single step tasks. The task-based class works in groups and pairs which requires negotiation, and is a multiple step task, as indicated by '-single step'. The traditional class does not work in groups or pairs but some activities are considered multiple step tasks, as indicated by '±single step'.

The resource-directing dimension is given in the second row. The complexity of the resource-directing dimension is high for the task-based class. The class most frequently is given tasks that require a multiple perspective, as indicated by the '+many elements'. Complexity along this dimension is also high with respect to being able to give other people's perspectives, as indicated by '+reasoning'. The task-based class is in many cases required to refer to abstract concepts in the there-and-then perspective, as indicated by '+there-and-then'. In contrast the traditional class is at the opposite end of the resource-directing dimension that is considered to be less cognitively demanding and hence less complex, as indicated by '+few elements, +no reasoning, and +here-and now'.

Therefore we would expect to find that the task-based class produces language that is characterized by accuracy and complexity because the most frequently used tasks are cognitively demanding along the resource-directing dimension. Further we would expect that increased fluency is minimal because the task-based class is less challenged with real-time demands along the resource-dispersing dimension. The traditional class, on the other hand, is not exposed to demanding resource-directing aspects which would suggest that their language is not characterized by accuracy and complexity. Further, the traditional class should exhibit greater improvement in fluency because they have done activities that are complex along the resource-dispersing dimension that promote fluency.

**Pre-test and post-test results**

Table 2 lists the results from the pre-test and post-test in terms of class improvement percentages. The table of class improvement results only partially confirms what the analysis of task complexity using Robinson's Cognition Hypothesis predicts.

	Task-based learning class	Traditional class
Written- structural complexity	62%	33%
Written- accuracy	52%	61%
Written- vocabulary	70%	60%

Speech- fluency	75%	65%
Speech- structural complexity	75%	44%
Speech- accuracy-error free AS units	63%	89%
Speech-accuracy-ratio of errors to words	88%	78%
Speech-accuracy-number of self-repairs	50%	11%

Table 2: Percentage of class improvement

The traditional class produces more accurate and error-free language, but produces less complex language in both the written and spoken data. There is also measurable improvement in fluency, as indicated by the fact that over two thirds of the class has improved, but this is still less than the task-based class result. The results of improved fluency and unimproved complexity coincide with the summary of task type given in Table 1 and confirm the Cognition Hypothesis prediction on this point. However, in terms of accuracy there is a discrepancy. According the Robinson's predictions, accuracy is developed through exposure to demanding resource-directing aspects which is not the case in the traditional class. Whereas written accuracy is just below the improvement mark at 61% improvement, speech accuracy, as measured by error-free AS-units, yields a high level of improvement at 89%. In short, the traditional class pupils are characterized by producing less complex language but more accurately in speech, such that accuracy and complexity appear to compete for attentional resources.

In contrast, the task-based class produces language with greater fluency and more complexity, but they make more errors in both written and spoken language. Based on the summary of task type given in Table 1, we would expect that since the task-based class has exposure to demanding resource-directing aspects, their accuracy and complexity have improved, but not their fluency. The task-based class is not challenged with real-time demands, based on their most frequently used activities as indicated in Table 1, and we should therefore not anticipate fluency development. However, fluency is measured as improving for 75% of the class. Written accuracy improvement is low at 52% and speech accuracy improvement is at 63%. However, speech accuracy as measured by ratio of errors to word is high at 88%, suggesting that task-based class produces a generous amount of language.

In terms of vocabulary, the task-based class improves 70% and the traditional class 60%. This may suggest that presenting words and phrases in context without using glossary lists has more effect.

As summarized in Table 3 below, the Cognition Hypothesis predictions fully coincide with results of class improvement for both groups with respect to structural complexity. Regarding fluency, only the traditional class correlates with the Cognition Hypothesis predictions. Correlations are indicated in bold type.

	Task-based class	Traditional class
Cognitive Hypothesis predictions	+accuracy + <b>complexity</b> -fluency	-accuracy - <b>complexity</b> +fluency
Results from class improvement	-accuracy + <b>complexity</b> +fluency	+accuracy - <b>complexity</b> +fluency

Table 3: Correlations between Cognition Hypothesis predictions and results from class improvement

For the task-based class, fluency improvement may be attributed to group work and presentation focus. The task-based framework may have attributed to the structural complexity and in turn triggered increased fluency.

Accuracy, however, is more difficult for which to account, and an interesting phenomenon with self-repairs results complicates the picture further. Self-repairs indicate that pupils monitor their own output and are capable of correcting it based on their knowledge of the target language. With respect to self-repairs, 50% of the task-based class improves, whereas the traditional class improves by only 11%. In other words, the task-based class produces more 'risky' complex language, and they appear to have the knowledge to correct it.

### Concluding remarks

The two 10<sup>th</sup> grade classes in this study represent real pupils and real teachers over the course of one academic year. Comparing lessons and test results must be tempered with the fact that the time span and individual development of these learners may affect their language development results in ways that are difficult to assess or for which to account. However, two tools have been developed in the process that may be useful for teachers. First, a framework for lesson design that goes outside of the textbook and meets with motivational demands by pupils is provided by the task-based learning framework. This framework can be used to supplement a textbook. Second, a framework for identifying cognitive complexity is defined and shows that an awareness of the cognitive demands of tasks is important for language development when the textbook is used and activities are selected from it. The resource-directing and resource-dispersing dimensions provide tools for planning lessons and curricula that contribute valuable information for ensuring language development.

In this study, one 10<sup>th</sup> grade class follows a task-based framework and the other class follows a textbook. Both classes improve in language production, but in different areas. Using Robinson's dimensions for task complexity and his predictions for language development, certain trends are isolated based on the activities and tasks that are most frequently used in the two classes. Group work and pair work have a positive effect on the development of structural complexity in the task-based class. The focus on grammar and less cognitively demanding activities in the traditional class results in measurements of improved accuracy and less structural complexity. In hindsight,

perhaps more negotiating and interaction in group work could have had a positive effect on the traditional class. More language focus, in particularly written language could have had a positive effect on the task-based class.

The focus of this study has been on the types of activities and tasks that are most frequently used in the classes and measures of learner language production. Robinson's dimensions have provided a way of analyzing complexity in the classroom, thus providing a partial explanation of the results of learner language improvement. However, perhaps the most important finding that warrants further investigation is the role of the teacher. The teacher's role is essential and choices made by the teacher influence the language development process of pupils. Further study as to the role of the teacher, the opportunities teachers have to review their own teaching practices, and systems for teachers to analyze the progress of their pupils in order to make adjustments to their teaching practices is needed.

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