

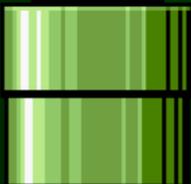
Using survival analysis to explain dropout in autonomous CALL practice with web-based mini-games



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Practice

all activities in a L2
that focus on specific linguistic constructions
and that involve a considerable amount of
recycling, feedback, and often time pressure,
with the goal of developing explicit knowledge
about these constructions
as well as skills in the L2

Autonomous CALL practice is back

duolingo

Translate this text to Spanish

My name is tariq.

Mi nombre es Tariq

shift á é í ó ú
û ñ ç i

You can use the keyboard for most things. Try hitting Enter instead of clicking check.



You are correct.

Check Continue

Tons of data out there to analyze learning and engagement

Reply Reply List Forward Archive Junk Delete More

From Stephen Fancsali <sfancsali@gmail.com> ☆

Subject **[edm-announce] Jobs @ Duolingo: Multiple R&D Roles** 9/05/2017 22:28

To edm-announce@freelists.org ☆

[on behalf of Burr Settles]

Duolingo is hiring several research and data scientist positions. We already have a strong group of interdisciplinary scholars focused on novel applied research at the intersection of machine learning, computational linguistics, and cognitive science, and we are expanding quickly: <https://www.duolingo.com>

Duolingo is the world's largest online language learning service with **more than 150 million users worldwide**. Our apps have been selected as Apple's iPhone App of the Year and Google's Best of the Best for Android multiple times. Our scientists split their time between **primary research** on new and unique problems (publication is encouraged), and translating these research findings into **production systems that improve learning and engagement** outcomes for millions.

Candidates interested in user modeling, educational data mining, applied machine learning, NLP and/or speech processing should apply!

See the full advertisements for two positions below.

Cheers,

Analyzing tracking data – we've been doing it all along

Although logistically challenging and potentially time-consuming, analysis of tracking data goes a long way in putting CALL on solid empirical footing.



Robert Fischer

(2007) How do we Know what Students are Actually Doing?
Monitoring Students' Behavior in CALL.
Computer-Assisted Language Learning 20 (5)

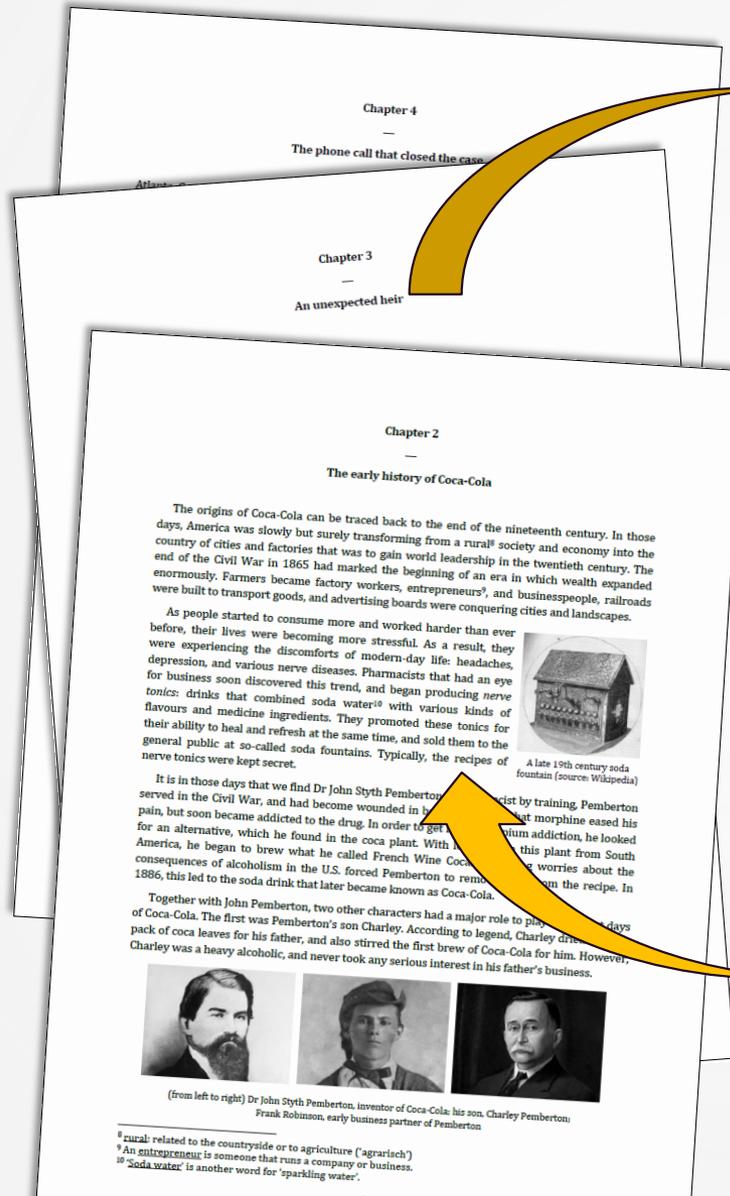
Key studies on autonomous CALL practice that used behavior tracking

- help seeking (Brandl, 1995; Cornillie *et al.*, 2013; Hegelheimer & Tower, 2004; Heift, 2001; 2002; 2006; 2013)
- uptake (Heift, 2004; 2010)
- automatization (Cornillie *et al.*, 2017; DeKeyser, 1997)
- self-efficacy (Bodnar *et al.*, 2017)
- time on task outside the classroom (Stockwell, 2013)
- dropout ?? (see Stracke, 2007 for a qualitative study)

Why study dropout in CALL practice

- Human-computer interactive CALL practice should be done largely outside the classroom.
- We need to understand the cognitive and motivational underpinnings of dropout in order to improve instructional design:
 - lack of prior knowledge
 - lack of progression
 - lack of motivation (intrinsic interest, goal orientation, ...)
 - ...
- We have the technologies and data to do it.

Learning environment



X 'Ingredients' is a countable noun in this context. The use of 'less' with countable plural nouns is generally considered incorrect, certainly in more formal English. The general rule is that you need to use 'fewer'. When you stick to the rule, you can't go wrong.

COPIES OF COCA-COLA USE LESS INGREDIENTS.

incorrect (F) **press SPACE** correct (J)

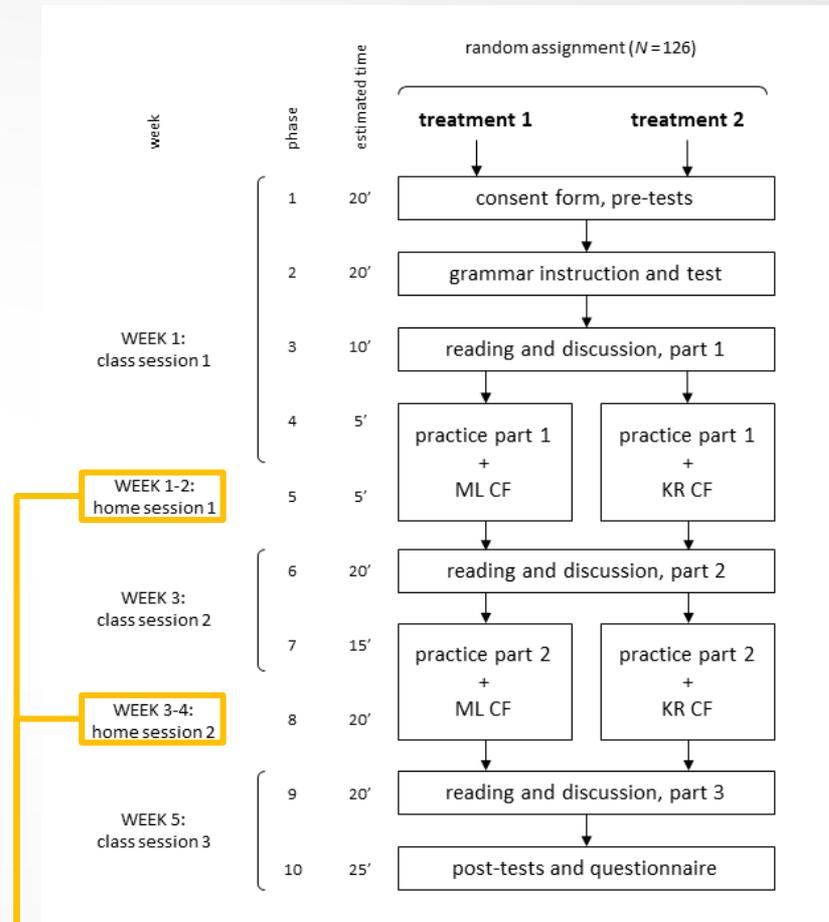
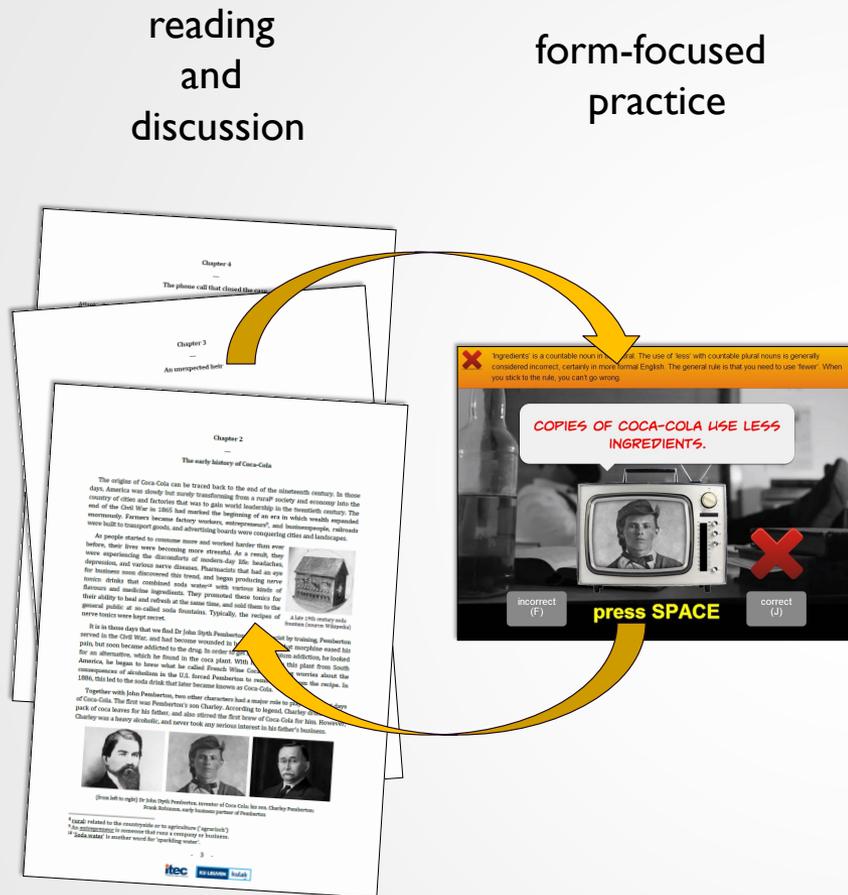
¹ **rural**: related to the countryside or to agriculture ('agrariach')
² An **entrepreneur** is someone that runs a company or business.
³ **Soda water** is another word for 'sparkling water'.

Research question

To what extent did L2 learners in secondary education drop out from autonomous practice with CALL mini-games in a blended learning environment, and what were the causes?



Materials and research design



autonomous practice at home

Cornillie, F., Van den Noortgate, W., Van den Branden, K., & Desmet, P. (2017). Examining focused L2 practice: from in vitro to in vivo. *Language Learning & Technology*, 21(1).

Design of the practice activities: feedback

Without error explanation:
knowledge of results (KR)

The screenshot shows a web browser window with the URL `spyling.appspot.com/path?session=aglzfnNweWxpbnFyHQsSEExvZ2dpbmdQcmItaXRpdmUYglCAwPT6gAoM`. The user is logged in as 'Undercover Detective'. The page title is 'DEBRIEFING'. A message at the top says: 'You made some mistakes. Here is some information that may help you to improve.' Below this, four sentences are listed, each with a red error marker and the text 'This sentence is grammatically incorrect':

- COPIES OF COCA-COLA USE LESS INGREDIENTS.
- DRINK COCA-COLA, AND YOU WILL HAVE LESS HEADACHES.
- COCA-COLA HAS ONLY LITTLE SECRETS FOR ME.
- WE MADE ONLY LITTLE COPIES OF THE COCA-COLA RECIPE.

The footer contains the text 'Do you need support?' and logos for iMinds, itec, KU LEUVEN, and kulak.

With error explanation:
metalinguistic feedback (ML)

The screenshot shows the same web browser window as the left image. The user is logged in as 'Undercover Detective'. The page title is 'DEBRIEFING'. A message at the top says: 'You made some mistakes. Here is some information that may help you to improve.' Below this, four sentences are listed, each with a red error marker and a detailed explanation:

- CHARLEY SOLD THE FEWEST BOTTLES.
Nothing is wrong with this sentence. 'Bottles' is a countable noun in the plural form, so you need to use 'fewest' if you want to express smallest quantity. The use of 'least' with countable nouns is generally considered incorrect, certainly in more formal English.
- COPIES OF COCA-COLA USE LESS INGREDIENTS.
'Ingredients' is a countable noun in the plural. The use of 'less' with countable plural nouns is generally considered incorrect, certainly in more formal English. The general rule is that you need to use 'fewer'. When you stick to the rule, you can't go wrong.
- DRINK COCA-COLA, AND YOU WILL HAVE LESS HEADACHES.
'Headaches' is a countable noun in the plural. The use of 'less' with countable plural nouns is generally considered incorrect, certainly in more formal English. The general rule is that

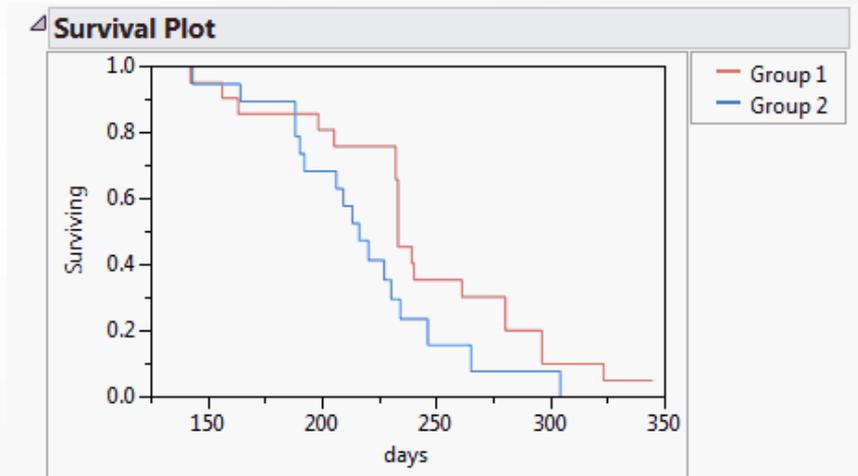
The footer contains the text 'Do you need support?' and logos for iMinds, itec, KU LEUVEN, and kulak.

Target structures

- quantifiers (QNT)
 - no distinction between count-uncount nouns in Dutch
 - *Copies of Coca-Cola use fewer ingredients / less sugar / ?*less ingredients.*
 - *Kopieën van het recept van Coca-Cola gebruiken minder ingrediënten/suiker.*
 - simple rule system
- verbs with two objects (V2O)
 - dative (*to-*) alternation and benefactive (*for-*) alternation
 - Constraint on verbs with Latinate verb stem for double object construction has no equivalent in Dutch
 - **Pemberton revealed me the secret formula.*
 - *Pemberton onthulde mij het geheime recept.*
 - complex rule system
- offered in interleaved way

Method: survival analysis

- Goal = analyze duration of time until one or more events happen, as well as the causes leading to these events
- Used in the medical sciences to predict death
- Variables:
 - Dependent: time until dropout
 - Independent:
 - Prior knowledge (explicit, implicit, metalinguistic)
 - Motivation
 - Error explanation yes / no



Prior explicit knowledge (PEK)

- task type: written discourse completion
- aim = measure productive grammar knowledge in formal contexts of use
- 7 items
 - 4 QNT
 - 3 V20
- reliability: Cronbach's $\alpha = .52$

You work as a pharmacist for Johnson & Johnson, and have just improved the recipe of a painkiller. You are in your boss's office, and want to convince him to produce your improved version of the painkiller. You think that you can convince him by saying that the quantity of ingredients needed to make the painkiller is much smaller now. You say:

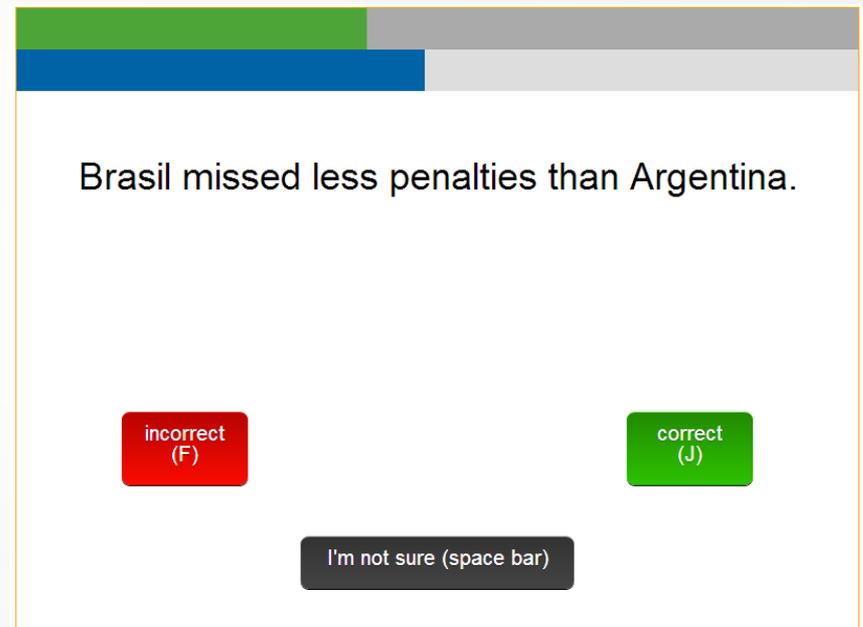
My new recipe is better than the old one, because it uses



You must use the underlined words.

Prior implicit knowledge (PIK)

- task type: grammaticality judgment, timed (3-7s)
- aim = measure implicit/automatized grammar knowledge
- 54 items
 - 24 QNT
 - 24 V2O
 - 6 distractor items
- reliability: Cronbach's $\alpha = .44$



Prior metalinguistic knowledge (PMK)

- 4 items
- measured after rule instruction
- reliability:
Cronbach's $\alpha = .22$

TEST OF ENGLISH GRAMMAR RULES

Name:

In this part of the test there are 4 sentences. All of them are NOT grammatically correct in formal English. The part of the sentence containing the error is underlined. For each sentence choose which statement explains the error best.

I buy less vegetables these days.

- Vegetable* is not a countable noun.
- The quantifier *less* is used with uncountable nouns.
- Vegetables* is a mass noun.
- Less* is not the comparative form of *little*.
- I don't know.

I don't have much problems with English grammar.

- In this sentence, *problems* is not used as a mass noun.
- You have to use *a lot of*.
- Much* cannot be used with plural countable nouns.
- Problems* cannot be counted.
- I don't know.

Motivation questionnaire

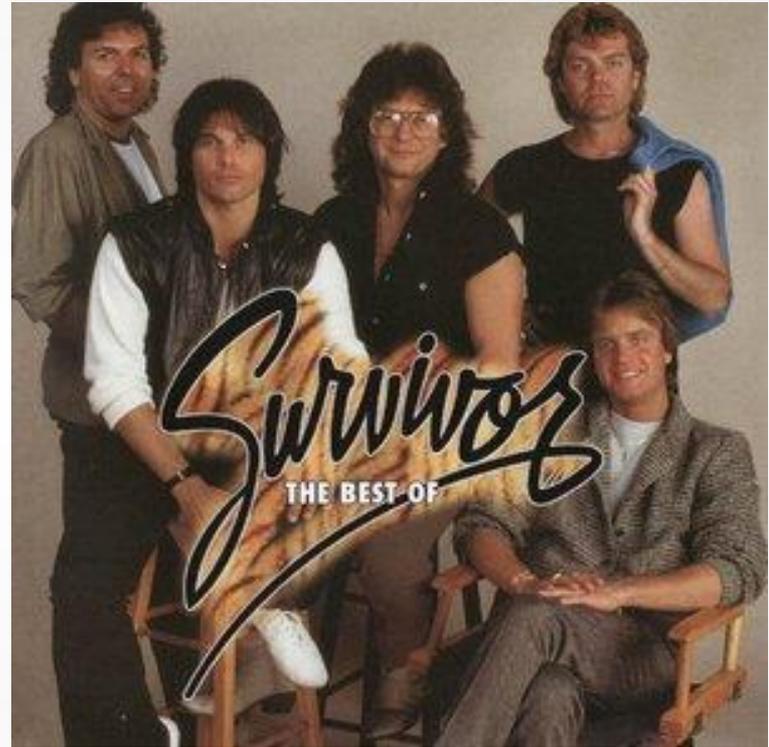
- Player Experience of Needs Satisfaction (Ryan, Rigby, & Przybylski, 2006)
- constructs:
 - interest/enjoyment (INT)
 - perceived competence (PC)
 - perceived immersion (PI)
- 24 items
- measured after treatment
- reliability: Cronbach's $\alpha =$
 - .89 (INT)
 - .89 (PC)
 - .76 (PI)

De onderstaande vragen peilen naar jouw motivatie terwijl je grammatica oefende in de elektronische oefenomgeving.

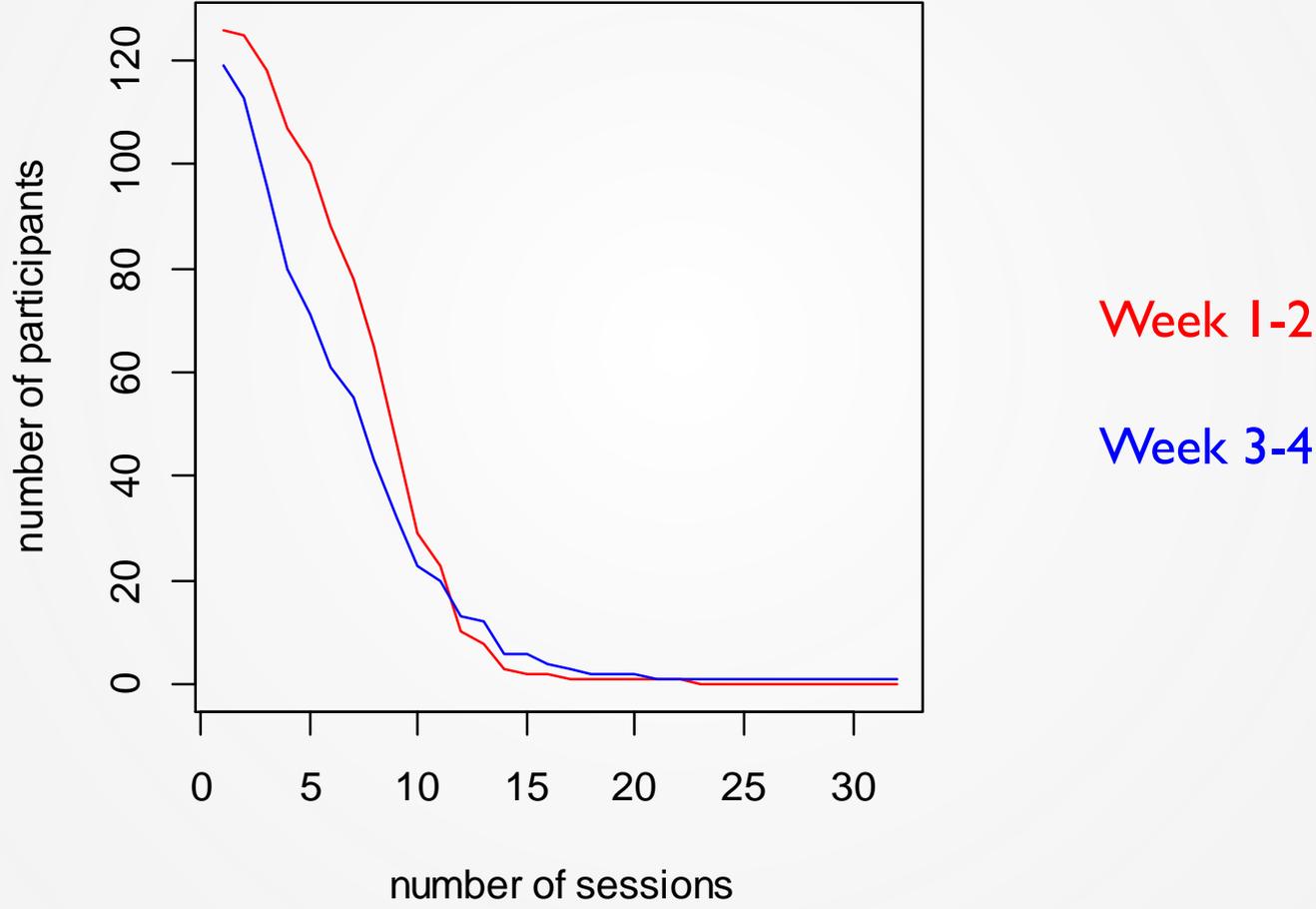
Lees de vragen één voor één aandachtig, en zet een kruisje in de kolom die het best jouw mening weergeeft.

Vraag	Helemaal onzeens						Helemaal eens
	1	2	3	4	5	6	7
9. Na het oefenen was ik in staat aan iemand te vertellen waarover de personages spraken.							
10. Ik ben tevreden met de prestatie die ik neerzette tijdens het oefenen.							
11. Na een tijdje geoefend te hebben, voelde ik mezelf wel tamelijk sterk in het maken van de oefeningen.							
12. Ik vond het oefenen tamelijk leuk.							
13. Tijdens het oefenen voelde ik me betrokken bij wat er gebeurde in het verhaal.							
14. Ik denk dat ik goed was in het oefenen, in vergelijking met mijn klasgenoten.							
15. Tijdens het oefenen heb ik de gebeurtenissen in het verhaal ervaren alsof ze echt waren.							
16. Terwijl ik oefende, bedacht ik hoe leuk ik het wel vond.							
17. Ik hield ervan om te oefenen.							
18. Het oefenen was een opdracht die ik niet goed kon uitvoeren.							

Who survived,
and why ?



Dropout was pretty massive



Survival analysis: dropout related to higher explicit knowledge (weeks 1-2) and lower perceived competence (weeks 3-4)

Quantifiers

	Week 1-2		Week 3-4	
	Sign. factors	B	Sign. factors	B
SA session 1	N/A		N/A	
SA session 2	N/A		PC *	-1,281
SA session 3	-		PC **	-0,837
SA session 4	-		PC **	-0,656
SA session 5	-		PC **	-0,628
SA session 6	-		PC **	-0,463
SA session 7	-		PC **	-0,445
SA session 8	-		PC **	-0,386
SA session 9	-		PC *	-0,337
SA session 10	-		PC *	-0,314
SA session 11	PEK *	0,251	PC *	-0,294
SA session 12	PEK *	0,171	PC *	-0,296
SA session 13	PEK *	1,113	PC *	-0,312
SA session 14	PEK *	1,05	PC *	-0,273
SA session 15	N/A		PC *	-0,273
SA session 16	N/A		PC *	-0,256
SA session 17	N/A		PC *	-0,237

Verbs with two objects

	Week 1-2		Week 3-4	
	Sign. factors	B	Sign. factors	B
SA session 1	N/A		N/A	
SA session 2	-		PC *	-0,768
SA session 3	-		PC **	-0,658
SA session 4	-		PC **	-0,693
SA session 5	-		PC **	-0,526
SA session 6	-		PC **	-0,439
SA session 7	-		PC **	-0,392
SA session 8	-		PC **	-0,369
SA session 9	-		PC **	-0,335
SA session 10	-		PC *	-0,314
SA session 11	PEK *	0,99	PC **	-0,326
SA session 12	PEK *	1,05	PC **	-0,309
SA session 13	PEK *	0,993	PC **	-0,302
SA session 14	PEK *	0,957	PC *	-0,277
SA session 15	N/A		PC *	-0,282
SA session 16	N/A		PC *	-0,245

* $p \leq .05$

** $p \leq .01$

Poisson analysis: similar picture, but perceived immersion and prior implicit knowledge play a role too

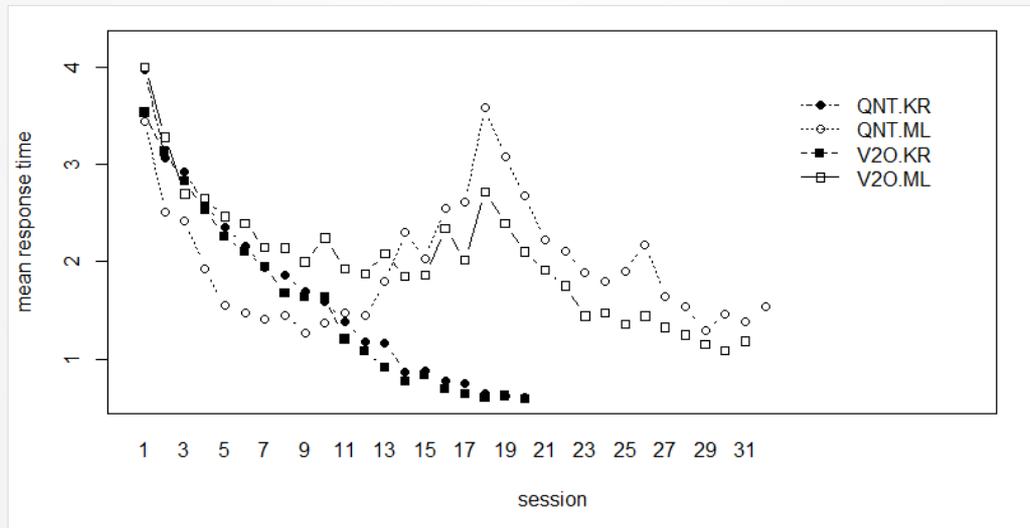
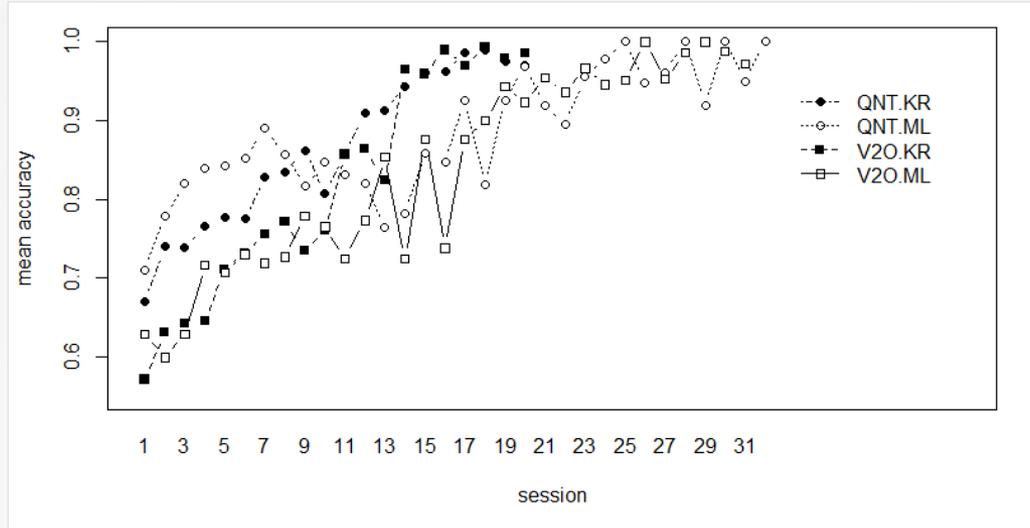
	Quantifiers	Verbs with two objects
Week 1-2	PEK *	PEK *
Week 3-4	PIK * - PC ** PI *	PIK * - PC ** PI *

Factors significantly related to dropout
(defined as: smaller number of sessions completed;
one outlier removed that had completed all sessions)

* $p \leq .05$

** $p \leq .01$

Next step: include progression in the model



Summary and loose ends ...

- **Summary**
 - Dropout was high
 - Dropout was related to explicit knowledge in the first practice period, and to perceived competence in the second practice period
- **Limitations**
 - Relatively short study
 - Loose coupling between mystery story and practice activities
 - Participants were stimulated to practice as much as possible at home
 - Motivation was measured only once
 - Goal orientation (competition) not measured
- **Implications**
 - Instructional design needs to focus primarily on competence satisfaction



Thank You !

