Newcastle University | Business School

Transitioning to University: Teaching Statistics to Economists

INERME Workshop 2024

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Content

- Motivation
- Let's look at some ILDs
- The Student Experience
- Future Developments

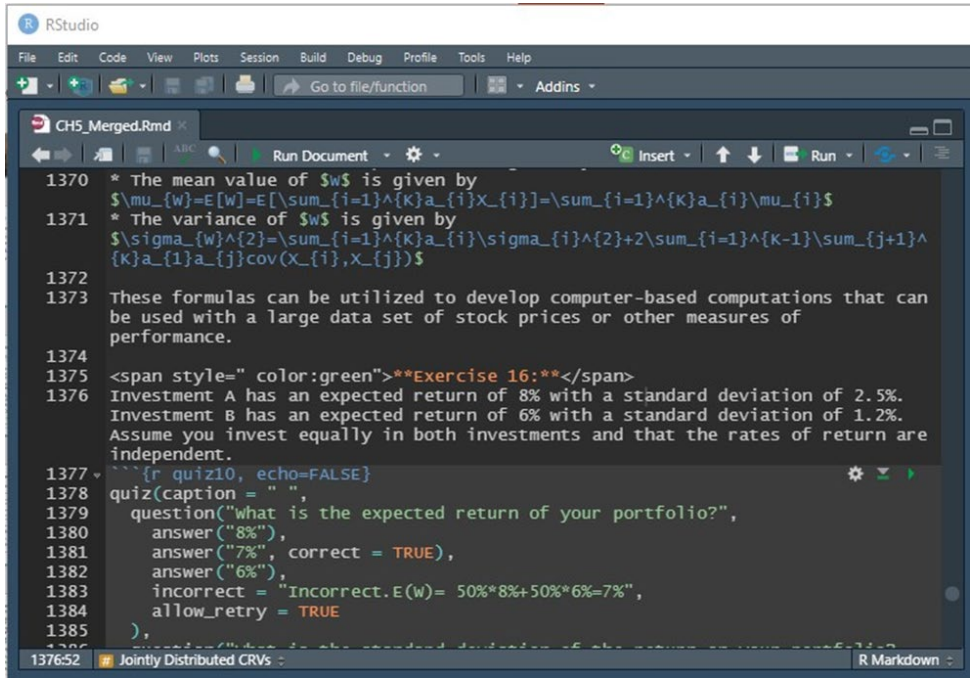
Motivation

- Overall, transitioning to university in the UK can be an exciting but challenging time. Universities typically offer support services such as academic skills workshops, counselling, student finance advice, and social programs to help ease this transition: Mathematics/Statistics Inductions, Mathematics Help-Desk etc..
- **Student Retention:** A smooth transition reduces dropout rates, ensuring students stay enrolled and progress through their studies.
- **Academic Success:** Helping students adapt early improves academic performance, leading to higher grades and overall student satisfaction.
- **Student Well-being:** Supporting the transition helps to reduce stress, anxiety, and homesickness, contributing to better mental health and well-being.
- **Institutional Reputation:** Positive student experiences during the transition reflect well on the university, enhancing its reputation and ability to attract future students.
- **Engagement and Belonging:** A successful transition fosters a sense of belonging, encouraging students to engage with the university community, clubs, societies, and academic networks.
- **Graduate Outcomes:** Early support helps students focus on long-term goals like career planning and employability, improving graduate prospects and employment rates

Motivation

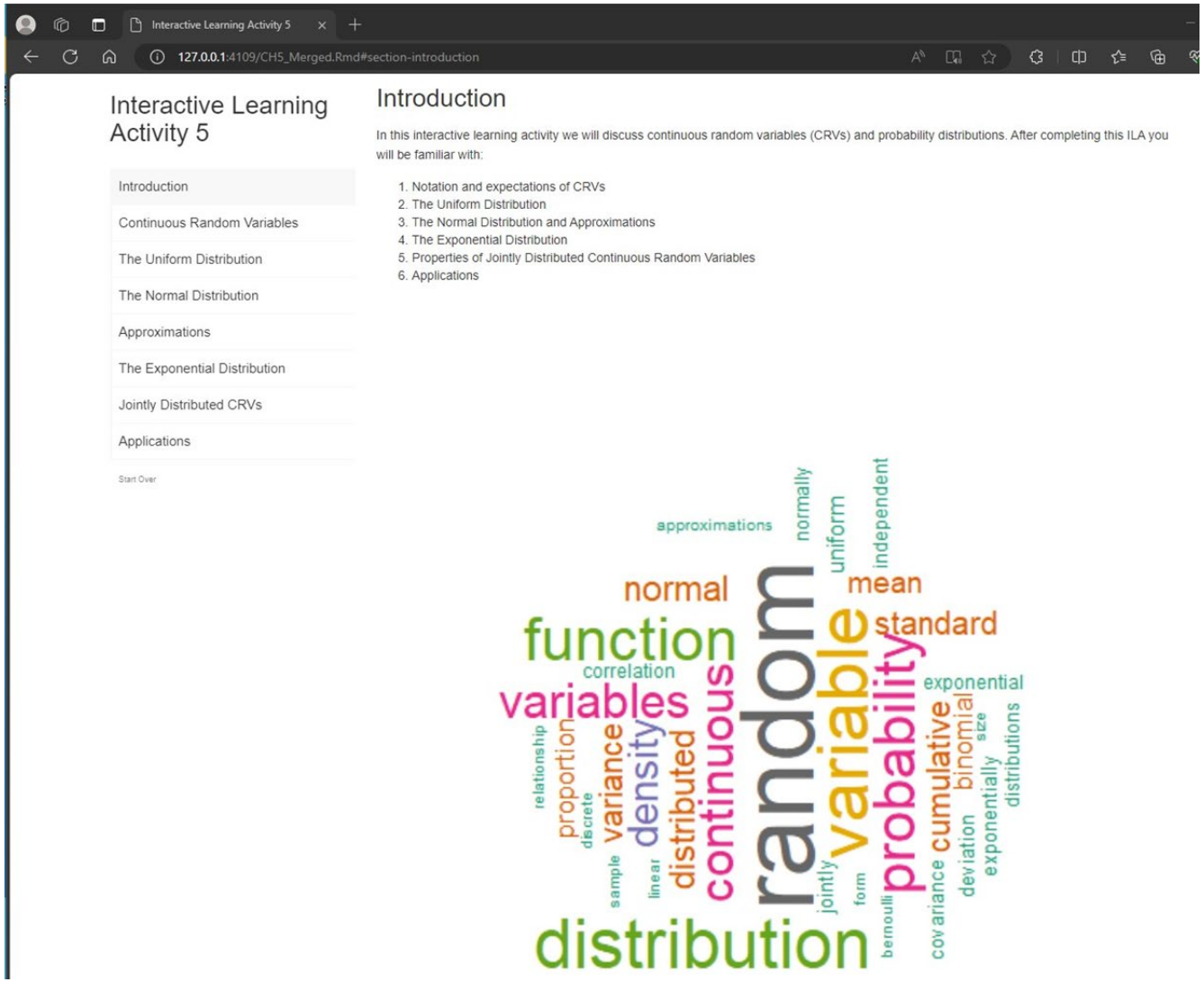
- Transition to Academic rigor (maths/stats)
- 20-30% experience personal difficulties
- Social Science students, lack of motivation and passion for mathematics/statistics
- 75% of students express some degree of mathematics anxiety (30% substantial)
- Original context, Covid-19 Pandemic

- Our Approach: We developed ILDs based on Shiny Apps



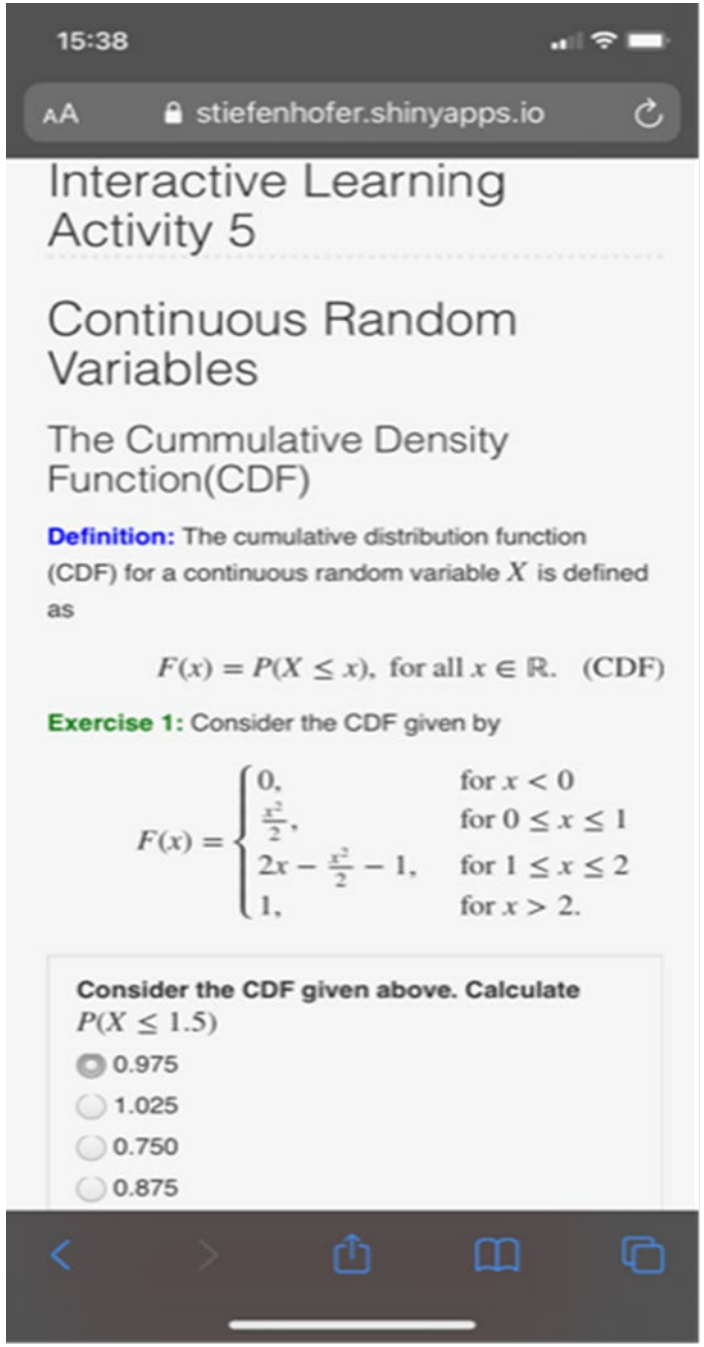
ILDs Apps

- Computer Interface



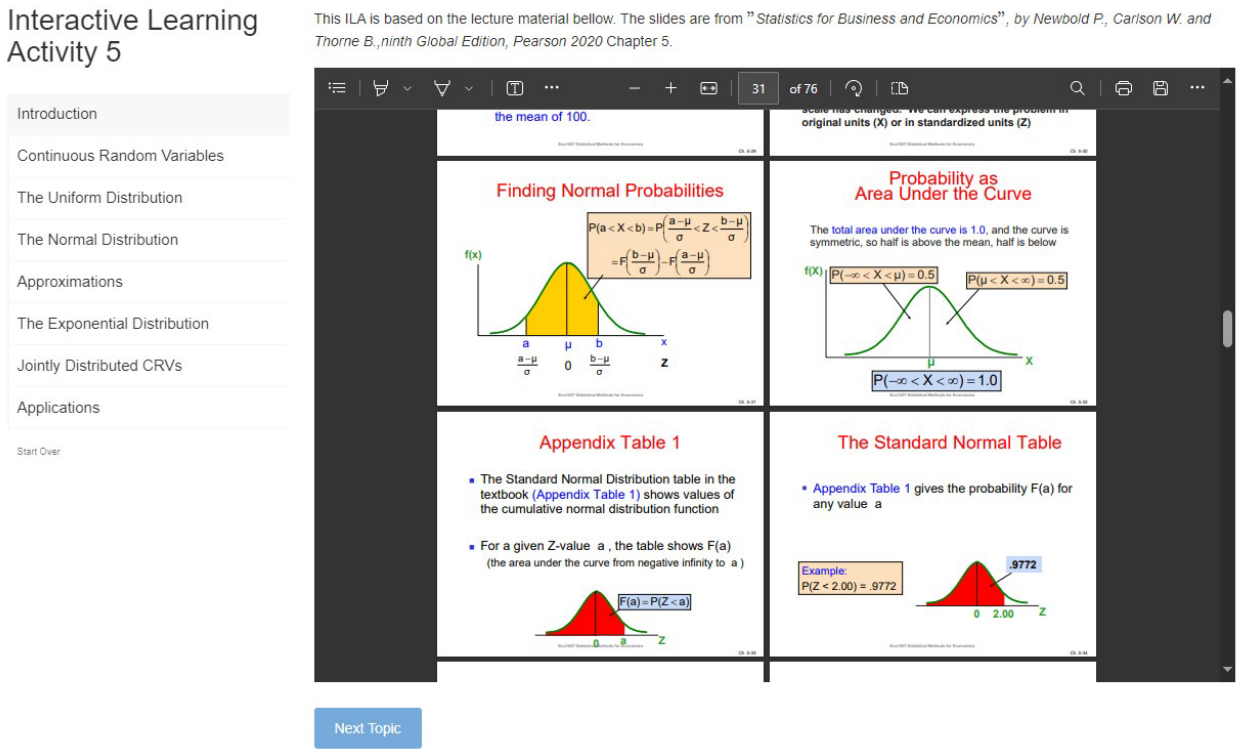
ILDs Apps

- Mobile Phone Interface



Properties of ILDs

- Organizing Learning Material
  - **Lecture Material**, Definitions, Theorems, Examples
- Engaging with Learning Material through Interactive Learning
  - Dynamic Interactions
  - Quizzes
  - Coding
  - Reproducing own Learning Problems
  - Solved Problems (Video Solutions)
  - Chatbot support (in progress)



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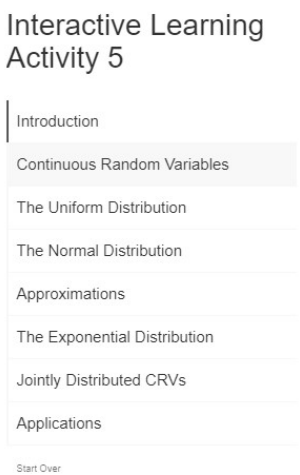

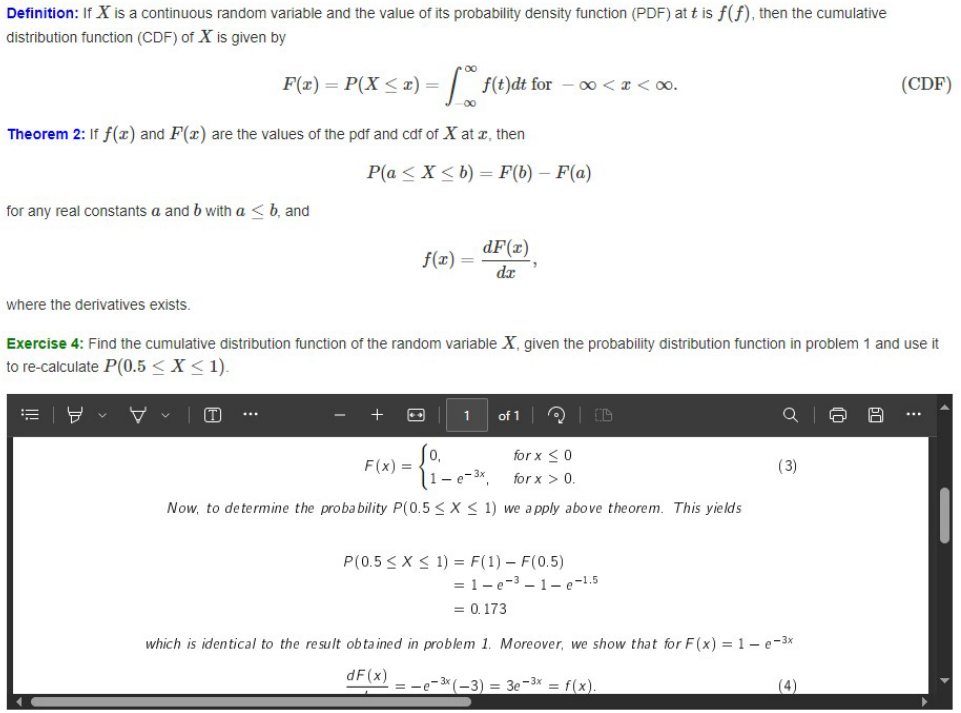

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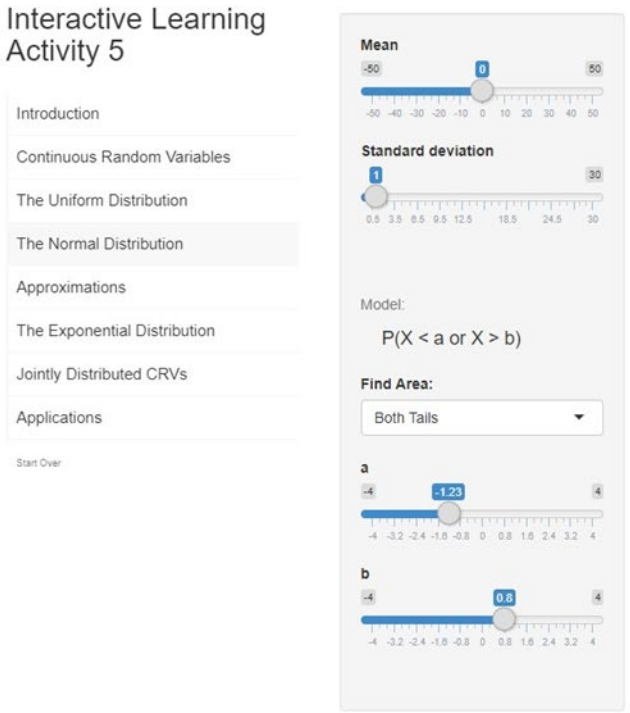

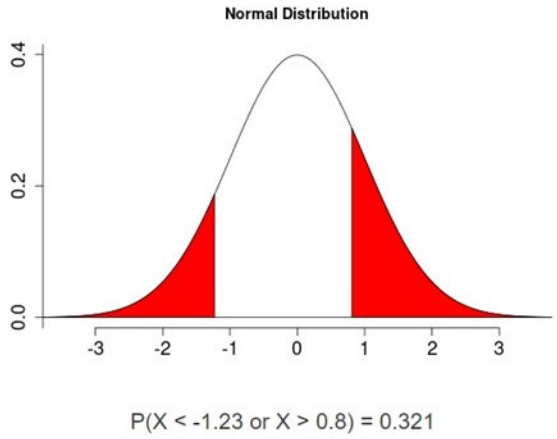

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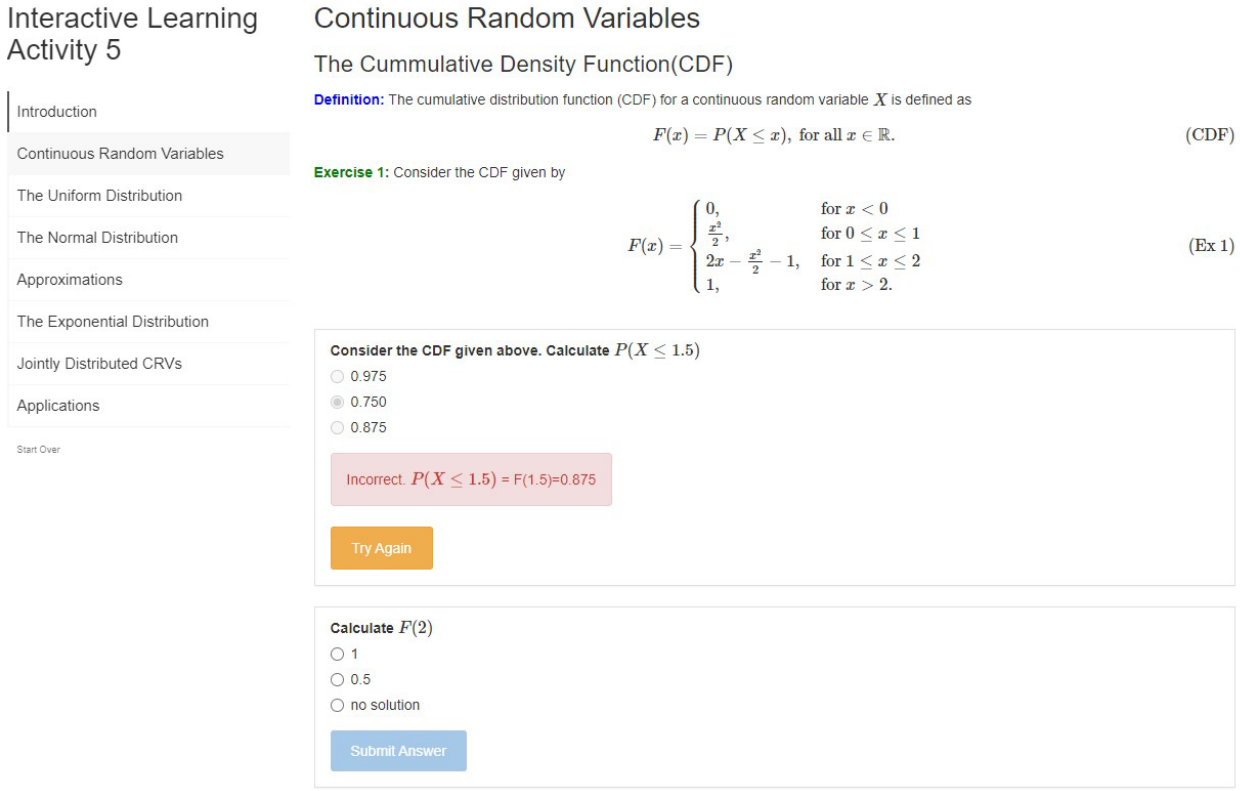

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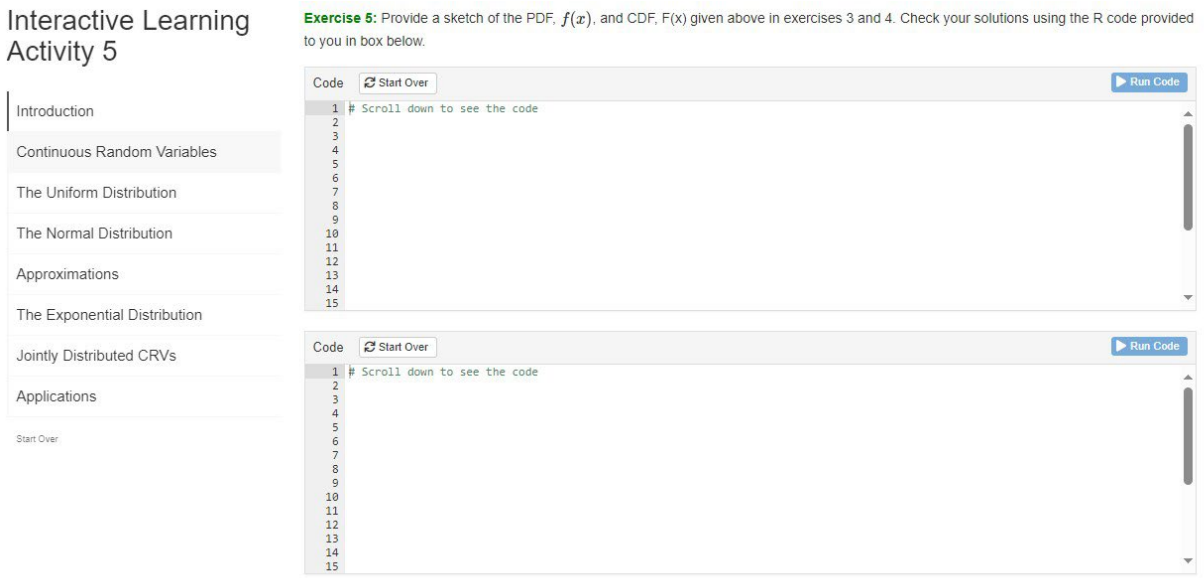

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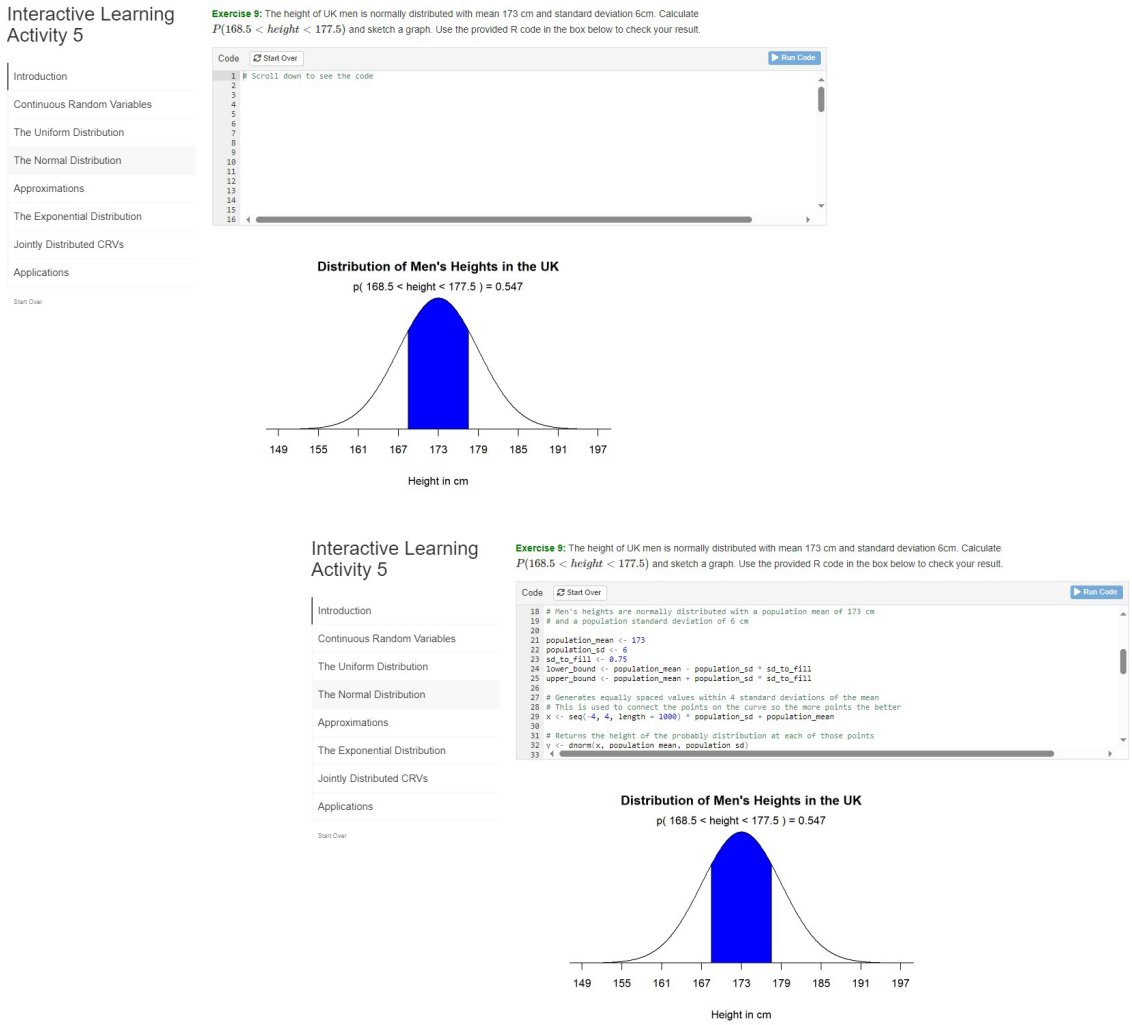

Properties of ILDs

- Organizing Learning Material
  - Lecture Material, Definitions, Theorems,
  - Exercises, **Problems, Data Sets**
  - Engaging with Learning Material through Interactive Learning
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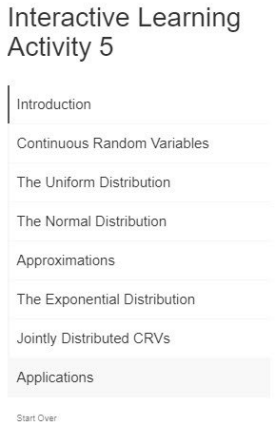
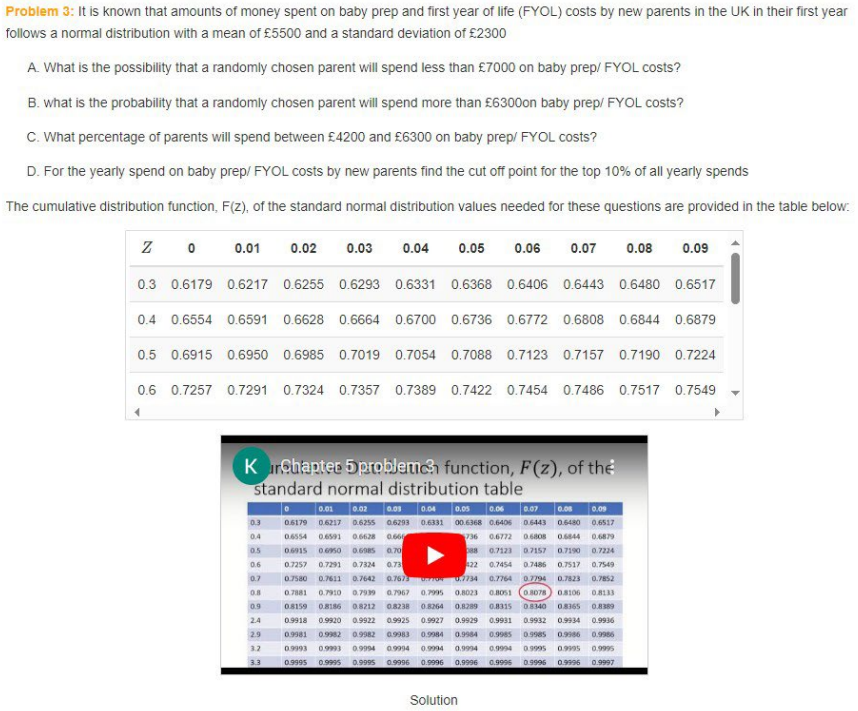




The Student Experience

- We conducted a survey with 32 stage 1 students from a cohort of 205
- Introductory Statistics Module ECO1007/2009 delivered at NUBS to economics students
- Students were provided with prototype ILD's designed to support Homework under Remote Emergency Teaching/Learning
- Each ILD is based on a Lecture which was delivered via video
- In addition to video lectures, students attended seminars, and workshops delivered via zoom
- Students report on their "gender", "self-assessed mathematics entry level", and "time spend on learning with the apps". They were asked to assess the ILDs and to compare them to their "usual" homework type

The Student Experience

Q 4: What sentences describe your experience with the Interactive Learning App?

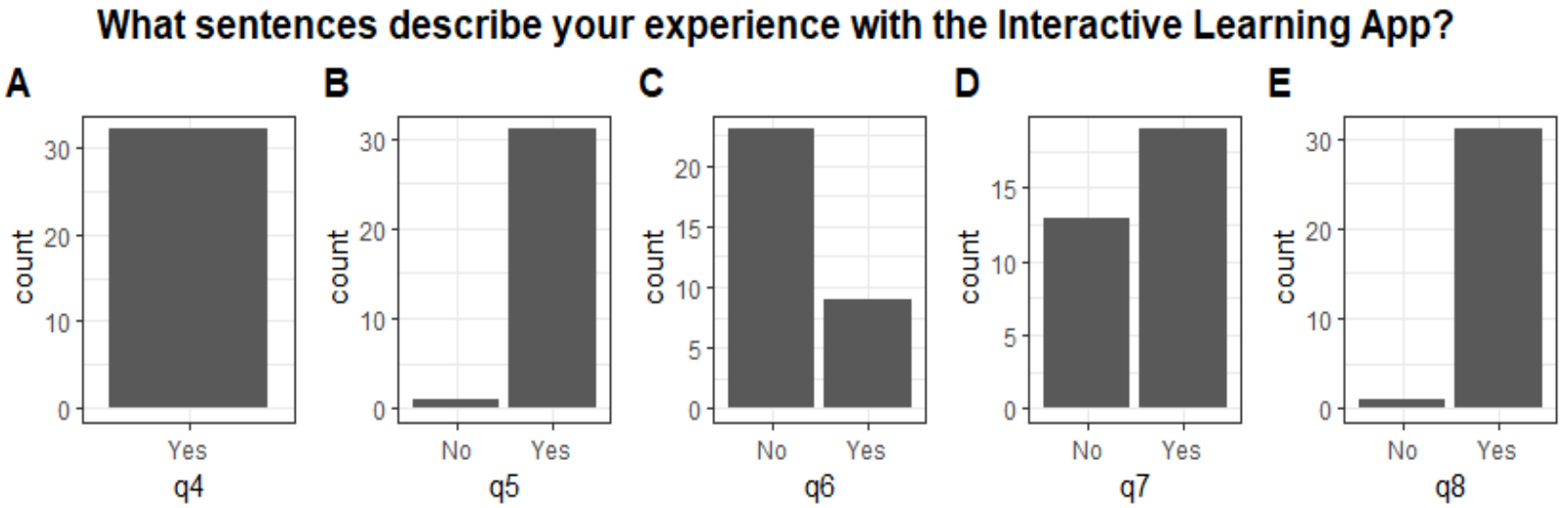
q4: [Its easy to use]

q5: [I feel engaged with my homework]

q6: [It's fun to use]

q7: [It's visually appealing]

q8: [It's easy to navigate]



The Student Experience

Q 5: Comment on the features of the Interactive Learning App (Recall that the App is expected to replace weekly homework activities and not substitute lectures/ tutorials/seminars).

q9: [Recall of definitions and results in compact form]

q10: [Short questions to check understanding of definitions]

q11: [Solutions to multiple choice questions]

q12: [Using pre-written R code to check solutions]

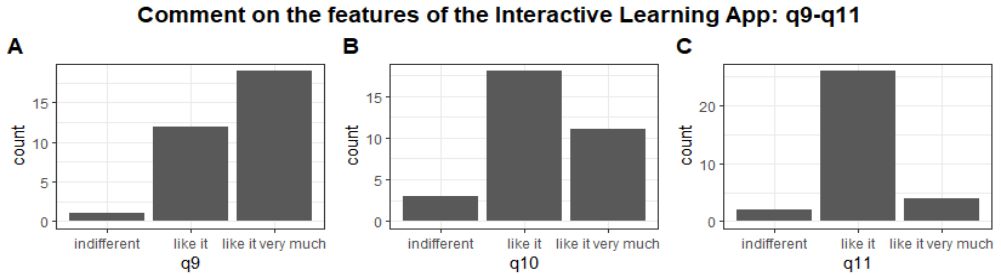
q13: [Embedded pdf files with detailed worked out examples]

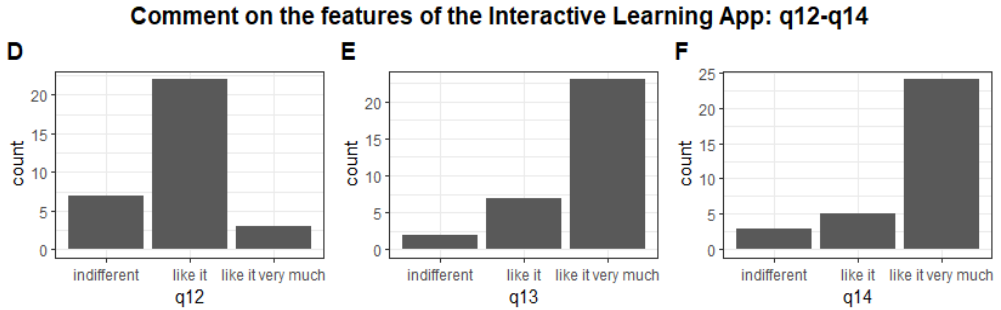
q14: [Interactive Dynamic Visualizations where I can choose parameters]

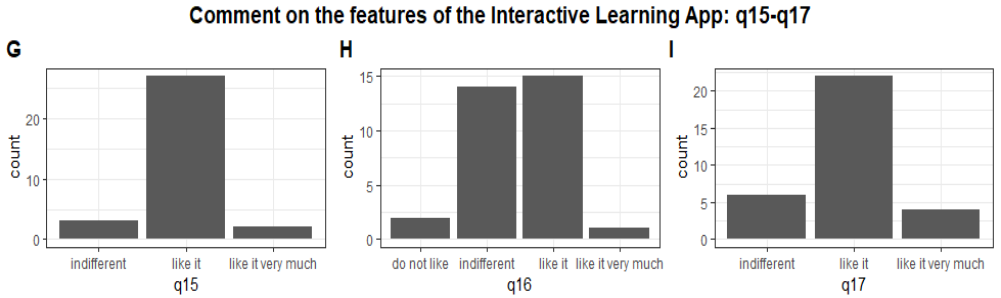
q15: [Applications with video solutions]

q16: [Code boxes (where I can use existing code or write own code)]

q17: [Pre-written code that generates graphs and solutions to problems]







The Student Experience

Q 7: Compared to this year's homework activity what is the expected effect of learning with Interactive Learning Apps on the following: q21-q26

q21: [I will like statistics]

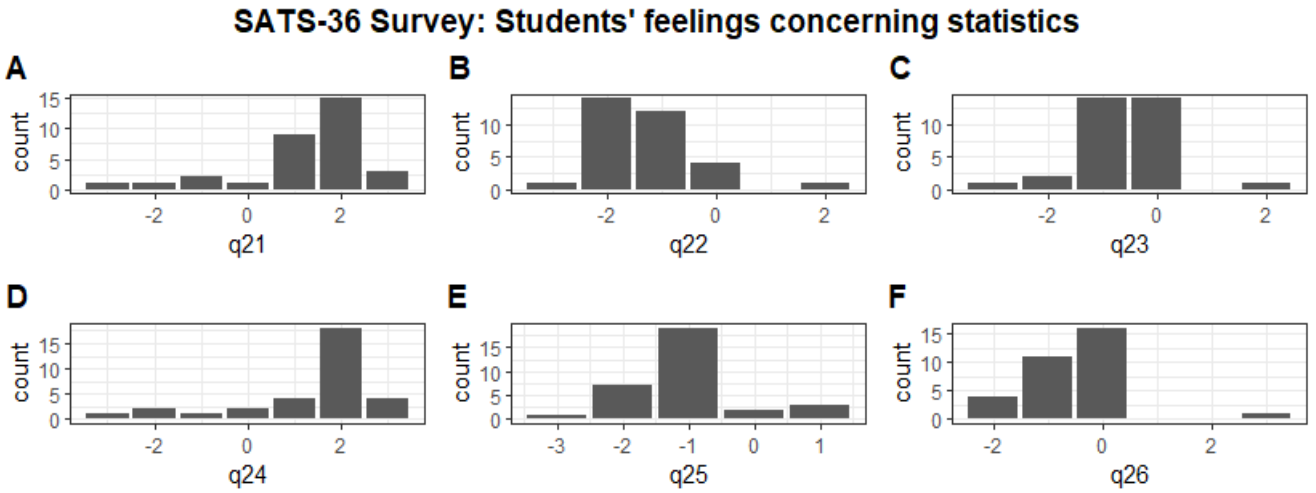
q22: [I will feel insecure when I have to do statistics problems]

q23: [I will get frustrated going over statistics tests in class]

q24: [I will enjoy taking statistics courses]

q25: [I'm scared by statistics]

q26: [I will be under stress during statistics class]



The Student Experience

Q 8: All questions are to be compared to this year's homework activity (quizzes without solutions, group chat room)

- q27: [I prefer Interactive Learning Apps (ILDs) to the existing homework type]
- q28: [Learning with ILDs improves my confidence]
- q29: [ILDs help me better prepare for exams]
- q30: [I learn more effectively with ILDs]
- q31: [ILDs better help understand difficult statistics concepts]
- q32: [ILDs provide more variation in learning]
- q33: [ILDs are more effective for exam revision]
- q34: [ILDs increase my learning motivation]

	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
q27	14 (44%)	15 (47%)	1 (3%)	2 (6%)	
q28	12 (38%)	16 (50%)	3 (9%)	1 (3%)	
q29	5 (16%)	23 (72%)	4 (13%)		
q30	5 (16%)	16 (50%)	10 (31%)	1 (3%)	
q31	5 (16%)	23 (72%)	4 (13%)		
q32	23 (72%)	8 (25%)	1 (3%)		
q33	14 (44%)	14 (44%)	3 (9%)	1 (3%)	
q34	5 (16%)	19 (59%)	6 (19%)	1 (3%)	1 (3%)

Some Further Analysis

Do ILD's help students reduce statistics anxiety?

Hypothesis: The mean of "Reduction of Statistics Anxiety" is equal to 3

- Cronbach's alpha: 99.17%
- Overall Satisfaction Rate: 76.88%
- Overall mean: 2.02 with variance 0.79
- K-S: D=0.23417, p-value=0.059882
- Data normally distributed
- t = -11.447, df = 31, p-value = 1.155e-12
- Reject Null Hypothesis
- CI 95% (1.844, 2.1935)

Table 1: Reduction of statistic anxiety

	1	2	3	4	5	Total	Mean	Variance	Statisfaction rate	Standard error
q21	18	9	1	2	2	32	1.78	1.36	84.38%	0.21
q22	14	12	4	0	2	32	1.88	1.11	81.25%	0.19
q23	3	14	14	0	1	32	2.44	0.62	53.13%	0.14
q24	22	4	2	1	3	32	1.72	1.64	81.25%	0.23
q25	8	19	2	3	0	32	2.00	0.69	84.38%	0.15
q26	4	11	16	0	1	32	2.47	0.69	46.88%	0.15
q28	12	16	3	1	0	32	1.78	0.55	87.50%	0.13
q29	5	23	4	0	0	32	1.97	0.28	87.50%	0.09
q31	5	23	4	0	0	32	1.97	0.28	87.50%	0.09
q34	5	19	6	1	1	32	2.19	0.71	75.00%	0.15
Total	96	150	56	8	10			7.92	76.88%	

Some Further Analysis

Do ILD's help students better manage large and complex quantities of learning material?

Hypothesis: The mean of "OrgInf" is equal to 3

- Cronbach's alpha: 99.19%
- Overall Satisfaction Rate: 87.5%
- Overall mean: 1.8 with variance 0.44
- K-S: D=0.21923, p-value=0.09229
- Data is normally distributed
- t = -15.864, df = 31, p-value = 2.2e-16
- Reject Null Hypothesis
- 95% CI (1.6422, 1,9515)

Table 2: Organization of learning context

	1	2	3	4	5	Total	Mean	Variance	Statisfaction rate	Standard error
q9	19	12	1	0	0	32	1.44	0.31	96.88%	0.10
q10	11	18	3	0	0	32	1.75	0.38	90.63%	0.11
q11	4	26	2	0	0	32	1.94	0.18	93.75%	0.08
q27	14	15	1	2	0	32	1.72	0.64	90.63%	0.14
q30	5	16	10	1	0	32	2.22	0.55	65.63%	0.13
q33	14	14	3	1	0	32	1.72	0.58	87.50%	0.13
Total	67	101	20	4	0			2.63	87.50%	

Some Further Analysis

Do ILD's help provide sufficient dynamic interactions for active learning?

Hypothesis: The mean of "DynIntLe" is equal to 3

- Cronbach's alpha: 83.04%
- Overall Satisfaction Rate: 87.5%
- Overall mean: 1.82 with variance 0.32
- K-S: D=0.21011, p-value=0.1185
- Data is normally distributed
- t = -17.508, df = 31, p-value = 2.2e-16
- Reject Null Hypothesis
- 95% CI (1.6846, 1,9591)

	1	2	3	4	5	Total	Mean	Variance	Statisfaction rate	Standard error
q12	3	22	7	0	0	32	2.13	0.30	78.13%	0.10
q13	23	7	2	0	0	32	1.34	0.35	93.75%	0.10
q14	24	5	3	0	0	32	1.34	0.41	90.63%	0.11
q15	2	27	3	0	0	32	2.03	0.16	90.63%	0.07
q16	1	15	14	2	0	32	2.53	0.44	50.00%	0.12
q17	4	22	6	0	0	32	2.06	0.31	81.25%	0.10
q32	23	8	1	0	0	32	1.31	0.28	96.88%	0.09
Total	80	106	36	2	0			2.24	83.04%	

Future Developments

- Compassionate Language in Chatbots
- Course Support Chatbots

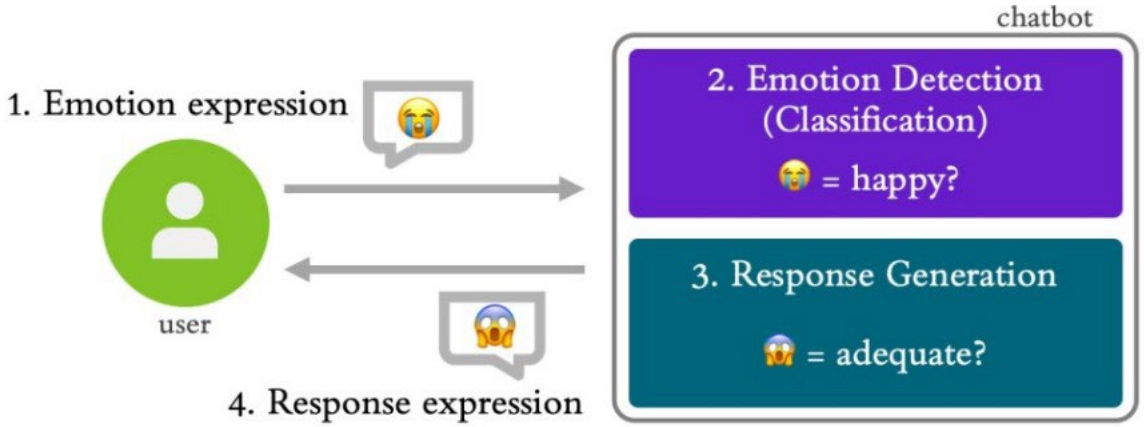


Figure: The 4 Stages of Empathy (Spring et al 2019)

Thank You

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