Chatbot learning assistant for Feynman Technique

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ABSTRACT

Feynman learning technique is an efficient and effective learning method, helping learners build a deep understanding of what they are learning. However, people often find hard to implement it while learning on their own or find a right study partner to help them practice it. To address this problem, we design a smart chatbot to help users to implement Feynman learning technique on their own whenever and wherever they want. We also design a user study to evaluate whether users find chatbot useful to assist them implementing Feynman technique.

KEYWORDS

Feynman technique, chatbot, active learning.

ACM Reference format:

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1 INTRODUCTION

Feynman learning Technique is designed to help learners to understand an abstract concept better through explaining it to others, especially to those who know little about the concept. Learners are required to simplify their explanation in order to resolve the questions raised by the others and make them fully understand the concept. Through the whole explaining process, learners are pushed to a deeper and deeper level of understanding of this concept.

According to the research of Fiorella and Mayer [3], interactions and feedback when learning by teaching make students gain a deeper and persistent understanding of learning materials than solely preparing to teach. Thus, it will be more efficient to implement the Feynman learning technique with real people to gain interactions and feedbacks though the Feynman learning technique can be performed solely by pretending to explain to others.

However, it's often hard to find someone who happens to be at the beginner level of the concept to help you study the concept together and patiently keep asking your questions and give feedback. Besides, learners will easily stop at a very shallow level when implementing the Feynman learning technique themselves since they would easily consider their explanation as acceptable and understandable.

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Questions raised by the know-nothing people and finally make them understand the concept. As a result, learners will reach a deeper learning level of this concept through this process. Feynman technique is an active learning method, which gets learners involved in interactions with others, getting feedback and discovering their flaws in learning. The process of explaining or pretending to others and simplify explanations is similar to learning by teaching, both requiring learners to make others understand their explanation by using simple terminology and possibly creating analogies.

Therefore, our research question is "whether users will find it more useful when implementing the Feynman learning technique with the assistance of a smart chatbot than implementing the learning technique on their own". To answer this question, we aim to design a smart chatbot assistant to help learners to learning with the Feynman learning techniques. This chatbot will be like learners' study partner, listening to their explanations and give them feedback. Our main contributions are:

A smart chatbot learning assistant to help users implementing the Feynman technique.

A user study to evaluate whether a chatbot is useful to users in helping them to learn with the Feynman learning technique.

2 BACKGROUND AND RELATED WORK

2.1 Feynman technique

Feynman Technique [10] is a learning technique named after the well-known Physicist Richard Feynman, which is designed to help learners to understand an abstract concept better through explaining it to others, especially to those who know little about it. During the explaining process, learners would try to simplify their explanation in order to resolve the questions raised by the know-nothing people and finally make them understand the concept. As a result, learners will reach a deeper learning level of this concept through this process. Feynman technique is an active learning method, which gets learners involved in interactions with others, getting feedback and discovering their flaws in learning. The process of explaining or pretending to others and simplify explanations is similar to learning by teaching, both requiring learners to make others understand their explanation by using simple terminology and possibly creating analogies.

2.2 Active learning

Active learning is opposite to passive learning [8]. Passive learning is a prevalent traditional teacher-centered learning method, in which way students just receive the input of provided learning materials [7]. In contrast to passive learning, active learning is student-centered [6]. According to the definition of the Green Wood Dictionary of Education [1], active learning get students involved in the activities which forces them to reflect upon ideas and upon how they are using those ideas, which keeps students

mentally and often physically active in their learning through activities that involve them in gathering information, thinking and problem solving. Research done by Michael (2006) provides the evidence that active learning works better than passive learning.

2.3 Chatbot

Chatbots, or conversational agents are adopted in many different industries such as customer services, commerce, entertainment as well as education.

ELIZA [9] was one of the first chatbots made certain kinds of natural language conversation between man and computer possible. ELIZA can analyze input sentences according to its decomposition rules selected by keywords in the input sentences. The reassembly rules associated with the selected decomposition rules are used for generating the responses.

Ch2R (Chinese Chatter Robot) [5] is a Chinese conversational dialogue system for online shopping guide, which can provide users with a platform to inquire about information of mobile phone in Chinese. A mixed-initiative framework is proposed to provide active assistance and subjective recommendations.

The chatbots can have a significant positive impact on education. The applications of chatbots in educational filed are ubiquitous. A web based Artificial Intelligent chatbot to assist high school students for learning their general knowledge subjects [2]. AutoTutor, an intelligent tutoring system with mixed-initiative dialogue that can hold conversations with the human in natural language and support language learning in classrooms. [4]

3 PROTOTYPE DESIGN

We designed the logic of a chatbot to simulates the process of implementing the Feynman learning technique based on the capacity of Watson Assistant created by IBM, which includes fuzzy matching for misspelling tolerance, synonyms checking and intent checking. The following flow chart shows the core logic of our chatbot. (Flow chart attached in appendix)

Our bot will let users choose what concept they want to learn and keep asking users to simplify their expiations of the concept until the explanations are easy enough to understand. The chatbot makes a judgement whether an explanation is easy to understand through detecting jargons. There are specific jargon libraries for different subjects in different areas. The chatbot only detects jargons under the same subject of the concept that the user needs to learn.

When users have made their explanations simple enough which means there is no jargon in it, the chatbot will ask users to make an analogy about the concept. Our chatbot is able to tell whether a sentence is an analogy. The whole process is finished when users give an analogy.

Plus, the chatbot will accumulate experience and knowledge from the replies of users. With those collected information, our chatbot will behave and respond more like a human. When someone is using Feynman technique with a real human partner, he or she will expect to get some response and useful feedback from his or her partner. Partners' responses will be more than just asking learners to simplify their explanation. It will contain some useful information like their thoughts of the concept. We are simulating this process by learning from users' replies. It will make the conversation more "human" and interactive. Also, users will discover something new and find out their flaws from those collected information.

4 USER STUDY

To answer our research question, "Will user will find it more useful when implementing the Feynman learning technique with the assistance of a smart chatbot than implementing the learning technique on their own?" We designed and conducted a user study. Originally, we plan to accomplish a chatbot by using Watson Assistant created by IBM and use it for the test. However, we found it is beyond our capabilities to build a chatbot that could apply all the functions and logics we designed. Therefore, we decide to let human to play the role of the chatbot, to simulate the process of the chatbot by following the rules we defined in advance. For the design of the chatbot, we referred to certain functions of Watson Assistant, for example, fuzzy matching, synonym, and intent checking. Users will talk to the fake chatbot performed by the volunteer through an instant messaging software.

4.1 Pilot study

We first conducted a pilot user study with one participant to access the methodology used our user study and get feedback of the prototype. The feedback from the participant was not positive because our methodology was not user-friendly and clear enough. There were some flaws in our prototype design as well. We re-designed our methodology of user study and made some improvements and new features to our prototype.

4.2 Methodology

To test our research question, we recruited 6 participants around 20s to participate in our user study.

The steps of our experiments:

Step1. A brief introduction to user about our experiment and the procedures they are about to go through. The experiment consists two parts, the first is to experience two different of using Feynman technique: Using Feynman technique to study on their own and studying with the assistant of our chatbot. After the learning, we will give participants another new topic to learn. They will choose the learning method they prefer to use from the previous experience. The evaluation part contains an online questionnaire as well as a brief interview about their feelings.

Step2. All participants will be introduced to Feynman technique and the chatbot learning assistant by reading our manual. If they have any questions about the manual, we can explain to them.

Below is the content of our user manual:

Part I introduction to Feynman technique

Step One: Choose Your Concept

The first step is to choose the concept you want to understand. Take a blank piece of paper and write the name of that concept at the top of the page.

Step Two: Pretend You're Teaching the Idea to a New Student

The second step is to write out an explanation, as if you were teaching it to someone who didn't understand the subject. This is crucial because in explaining to yourself the ideas you already understand, as well as the ones you don't, you gain a better understanding and pinpoint exactly the details you don't understand.

Step Three: Whenever You Get Stuck, Go Back to the Book

Whenever you get stuck, go back to the reference materials, lectures or a teacher assistant and re-read or re-learn the material until you do get it enough that you can explain it on the paper.

Step Four: Simplify and Create Analogies

Wherever you create a wordy or confusing explanation, try to either simplify the language, or create an analogy to understand it better.

You'll notice I did both of these in this quick demonstration. I simplified the language of torque, to explain it in terms of twisting. Second, I was able to describe it through analogy, by taking the torque vector and describing it as a corkscrew motion, tightening with right or loosening with left.

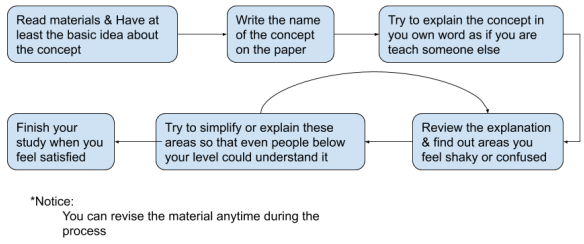
Keys when implementing the Feynman technique

1.Please **write down** your explanation.

2.Please explain it as if you are explaining to a **beginner** who barely knows nothing of the concept

3.Please try to explain the concept in simple words

4.Please try to **simplify** your explanation as much as you can

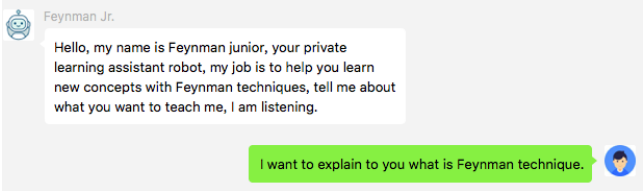


Part II introduction to our robot

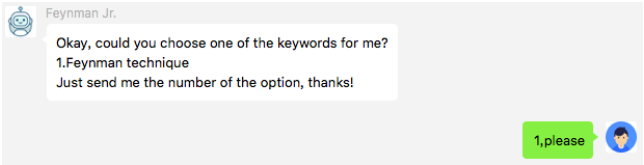
Imagine that our bot is a new student who does not know much about what you are going to teach him. Firstly, the users will try to explain a concept using their own words, and the bot will keep questioning the complex terms that it does not understand well, push the users to modify their explanation by suggesting them to use simpler terms, as well as challenge them to use one example to reinforce their understanding.

How to use it?

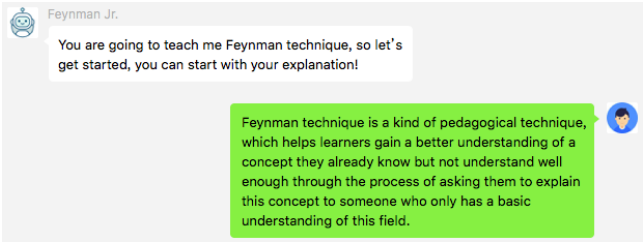
(1) The bot will greet in the beginning and ask you the subject that you want to teach. And you need to respond the subject you want to teach.



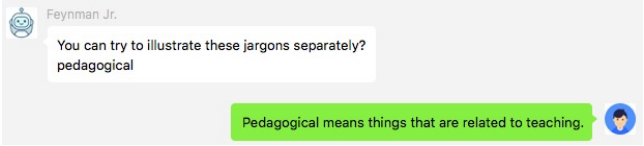
(2) The bot will continue to question the keywords with you, you just need to give it the number of your option.

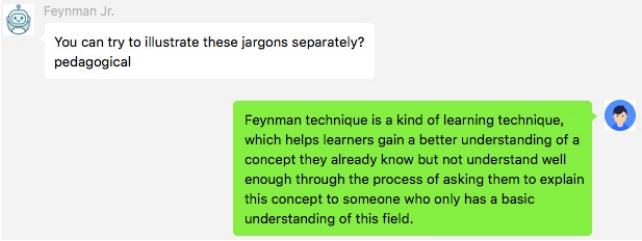


(3) The bot will confirm the keyword with you and ask you to start your explanation. You should input your explanation.



(4) The bot will suggest that you should try to illustrate the jargons of your explanation. You can either choose to illustrate the jargons or try to rephrase your explanation.





(5) Once your explanation achieves a good level. The bot will ask for an example to reinforce your understanding. And the bot will use the same jargons detection technique to push you to improve your example.

Step3. Begin the experiment, choose either method (alternatively) for user to carry out.

For self-Feynman method, we will offer the user a pan, a piece of paper, some materials for studying a certain topic. They could search for material on the Internet as well. During the study, one of our members will accompany the user, observing whether they are carrying out self-Feynman. We will strongly suggest the user to type, write down or try to speak out the explanation required in Feynman technique. The study will maintain around 20-30 min.

For the Feynman technique with assistant with chatbot method, we will offer the user some materials for another topic. After around 10-15 min basic study, we will ask the user to use our bot and study by following the instruction or suggestion of our bot. User could revise material anytime during the experiment.

	Feynman Technique on their own			
Feynman Technique with chatbot		**ROC**	**La mises-en-scène**	**Atmospheric circulation**
	ROC	\	Lucas Xie	Zhan Wu
	La mise-en-scène	Antoine	\	Lu Zhihui
	Atmospheric circulation	Shilang Xiong	Quantin	\

Table 1: The experiments of the participants

As shown in Table1, all the participants try both self-Feynman method and the Feynman technique with assistant with chatbot method.

In the appendix are some examples of prepared learning materials. These topics were chosen from different fields with different difficulties, which we consider could reflect how our chatbot works with different types of topics. All participants know little about these topics.

Step4. After the learning, we will give participants another new topic to learn. They will choose the learning method they prefer to use from the previous experience, Feynman technique on their own or our Feynman with chatbot. They will learn it first for about 5 - 10 minutes first and then we will ask about their choices about learning method. Participants only need to make the decision and don't need to really learn with it. However, they will not know it when they are making choices. With this "trick", the participants' choices are more likely to reflect their real preference and thoughts about these two methods. And we need to record their choice.

In addition, our chatbot are designed to accumulate experience and learn from users' replies. Participants' replies will be collected by our chatbot, which will be used to interact with following participants. To test whether an advanced bot with learning ability would bring user better learning experience, the latter 3 participants will experience the advanced chatbot apart from the basic chatbot. The advanced chatbot learns and accumulates experience through collecting the answers from the former 3 participants and use it to interact with participants.

These are some examples of answers the chatbot can collect and use for other participants.

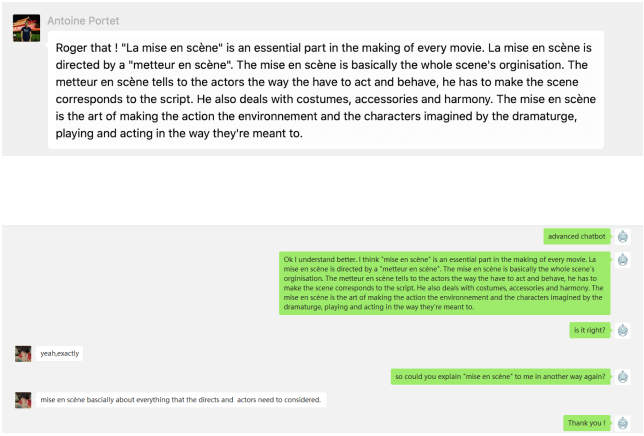


Figure 1: The answer of Antoine Portet (upper figure) is used for another participant Lu Zhihui (Bottom figure)

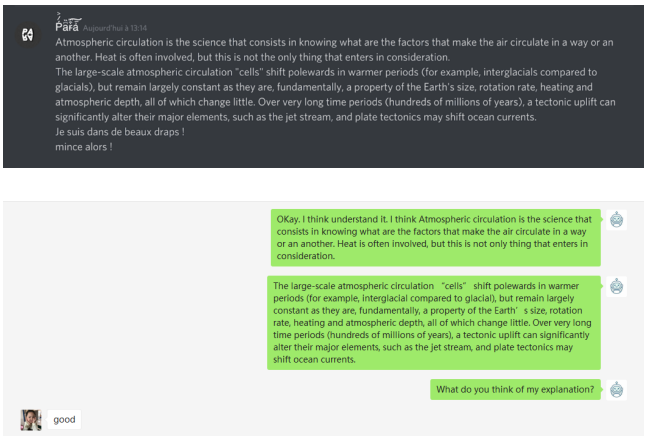


Figure 2: The answer of Quantin (upper figure) is used for another participant Shilang Xiong (Bottom figure)

Step5. In the evaluation part of our user study, participants will finish our online questionnaire. The participants will also be interviewed about their feelings, thoughts and feedback about Feynman technique and our chatbot learning assistant. The evaluation mainly focusses on user satisfaction. We value the users feels and satisfaction most. We mainly focus on two aspects. The first one if whether they feel learning is active. Active learning is very important, which drives learners to deep level of knowledge. We want to make our smart bot can make people feel the active in learning. Then we want to receive feedback from users. We would like to know if they find Feynman technique useful and whether our chatbot learning assistant helps them to implement the Feynman learning techniques well.

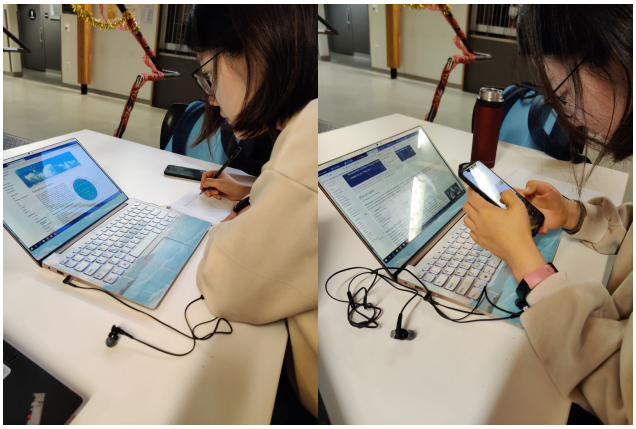


Figure 3: One participant implementing Feynman Technique on her own (Left). The participant using the "Feynman Jr. Chatbot" (Right)

5 RESULTS AND ANALYSIS

In our user manual, we put an instruction of Feynman technique, all the users have to read the manual to gain an idea of what is Feynman technique, and they have to try to implement it on their own. With respect to Feynman technique, most of participants think Feynman technique is useful, and only two participants think Feynman technique is not useful, they both think the application of the Feynman technique is very narrow and it can only be applied to certain kinds of problems, they reckon that topics like the concepts which are easier to understand and remember are not compatible for using Feynman technique to study them because it is relatively more time-consuming. One of the participants thinks he is just more used to his own study method.

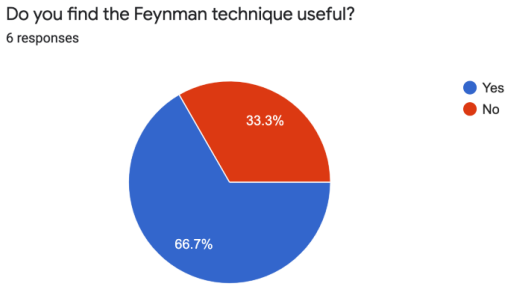


Figure 4: Participants' feedbacks to question "Do you find the Feynman technique useful?"

All the participants consider our chatbot as helpful for implementing Feynman technique and helping them with studying. They think our chatbot could help user smooth the process of implementing Feynman technique. Through the learning process of using Feynman technique on their own in the experiment part, the users might find some difficulties of studying with Feynman technique on their own. As shown in the figure 4, most of participants think they lack motivation to implement Feynman technique on their own and it is hard to find people to listen to them in real life. And one participant added particularly that he thinks some notions are too easy to motivate them to use the Feynman Technique. The possible reason could be this participant is from France, and one topic of our prepared material is about "La mise-en-scène", which is a cinematic term originally defined by a famous French director, so this French participant have an edge on understanding this topic. After the experience with our chatbot, the users think our chatbot can address some difficulties to some extent. More participants think the chatbot can solve the difficulties caused by the distance and unavailability of people in real life.

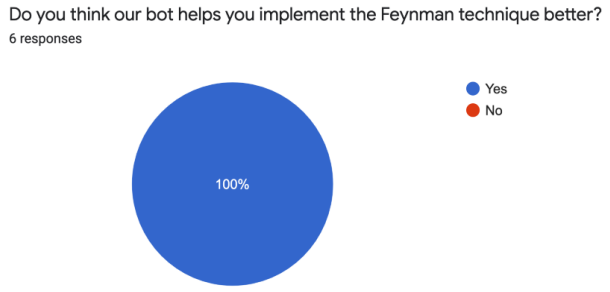


Figure 5: Participants' feedbacks to question "Do you think our bot helps you implement the Feynman technique better"

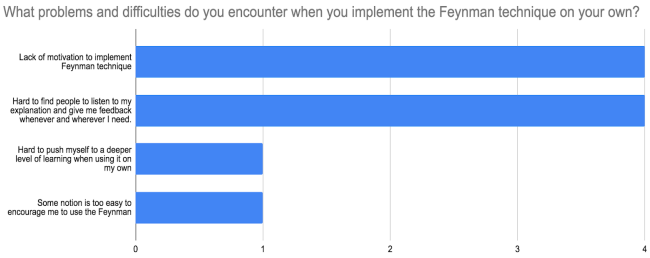


Figure 6: Participants' feedbacks to question "What problems and difficulties do you encounter when you implement the Feyman technique on your own"

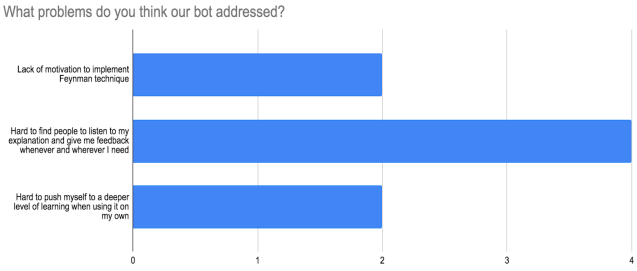


Figure 7: Participants' feedbacks to question "What problems do you think our bot addressed"

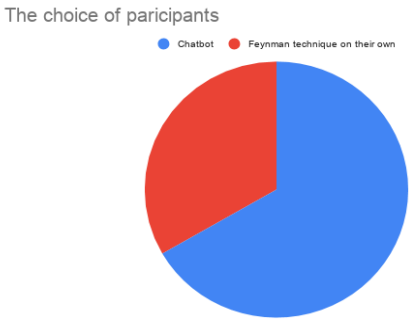


Figure 8: Participants' choice of the chatbot or Feynman technique on their own

After experiencing both Feynman technique on their own and with the chatbot, the participants were given another new topic to learn. As shown in the Figure 8, two-thirds of participants choose to study with the chatbot, only 2 participants chose to study on their own.

Plus, the participants' feedbacks about the advanced chatbot are positive. The chatbot can question them by using the answers collected from previous participants, they indicate that it is more interactive and provide them with different perspectives. Some participants express that this method can help them notice some important points they have missed during their leaning process.

We interviewed all the participants in the evaluation part, and they express their thoughts about the chatbot, some of the participants mention the advantages of our bot: It motivates the users to implement Feynman technique to study and encourage users to actually write down things to help themselves study. They do not need to take the factor of distance and unavailability of people who can listen to them into consideration if they use the chatbot to study by teaching.

The participants also mentioned the drawbacks of our chatbot. The bot is not very efficient because they have to type on laptop to communicate with the chatbot. Plus, the questioning method of the chatbot can be rigid because the method is only jargon-based. Besides, the chatbot seems less interesting than teaching a real person.

6 CONCLUSION AND FUTURE WORK

In conclusion, the idea of using a chatbot to assist users in implementing Feynman technique is possible. It could help users to have a clearer logic on how to carry out Feynman technique for learning and encourage them to implement it. Besides, a chatbot could enhance interactivity and motivate them to learn deeper about a certain topic since the chatbot would question users on jargons and urge them to explain. Nevertheless, this research also reflects some possible drawbacks of implementing Feynman Technique with a chatbot such as high time consumption, non-wide

applicability and low attraction compared with communication with a human due to its mechanized and rigid answers. Besides, it seems that not all conceptions are suitable for implementing either traditional Feynman Technique or Feynman Technique with a chatbot.

7 FUTURE WORK

To handle these possible problems and improve our chatbot, we consider it is possible to improve 1. its behavior as a learning assistant. 2. its behavior of assisting users to carry out Feynman Technique for learning.

For improving its behavior as a learning assistant, it might be possible to add the learning ability which allows the chatbot to collect users' answers to certain topics and use them as materials for future users. Besides, it might be possible to add some fixed high frequency and difficulty jargons to a certain topic. These jargons will be questioned by the chatbot even if the users do not include them insides their answers. This might be helpful for users to have a deeper understanding of the topic. What's more, the chatbot might be able to offer the user a conclusion on what they had learnt through this learning, which could help them to review the topic and have a better learning result. These improvements might be beyond the field of Feynman technique, however, we consider them as worthwhile if this could offer the user better learning experience.

If we want the chatbot only focus on the Feynman technique field, it is possible to improve it in the following aspects. First, it might be better if the level of jargon library is adjustable. Through our users' reflection, we found it might be unsuitable to offer all the users the same jargon library since they might have different education levels and knowledge levels in a certain field. For a higher knowledge level user, it might be better to offer them a jargon library with higher difficulty and including less low-level jargons and vice versa. Second, it should be considered to add additional detective methods rather than only detecting jargons such as the logic of the sentence. It is better if the chatbot could detect logic mistakes inside the answer. However, whether this is possible deserves further discussion. Third, it is possible to add voice function to the chatbot since this could improve interactivity and efficiency. Still, this needs the support of mature natural speech recognition. These respects could improve the chatbot for offering a better Feynman technique learning.

Nevertheless, this paper only proves the theoretical possibility, and the samples for the experiments is not large enough due to limited limit. Besides, there are no detailed jargon libraries used in the experiment and the type and number of topics are limited. Therefore, further researches with more samples, topics and detailed jargon libraries are expected. In addition, this research proves it is worth to try creating a chatbot for Feynman Technique. Whether the real chatbot could work as we expected is worth in-depth research.

ACKNOWLEDGMENTS

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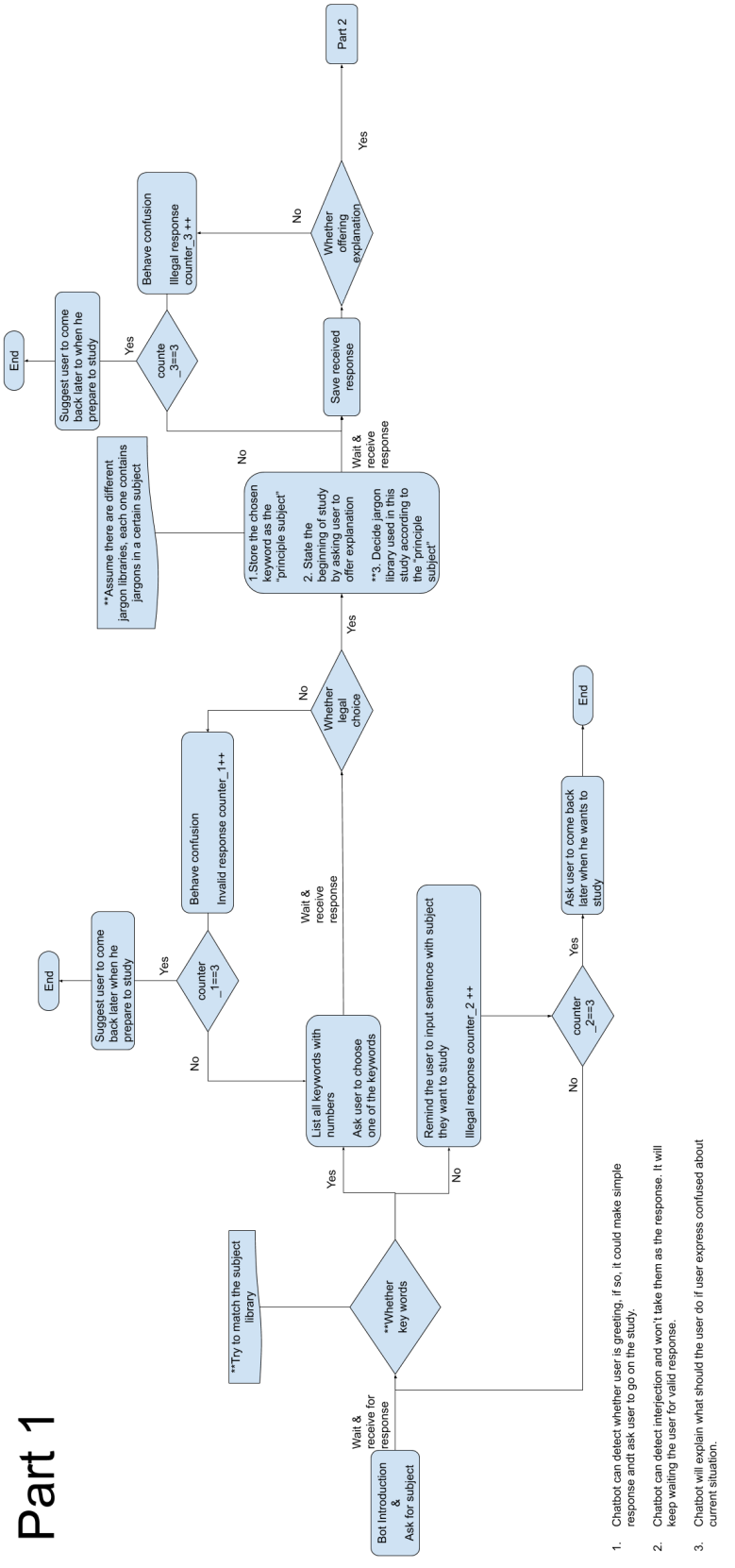
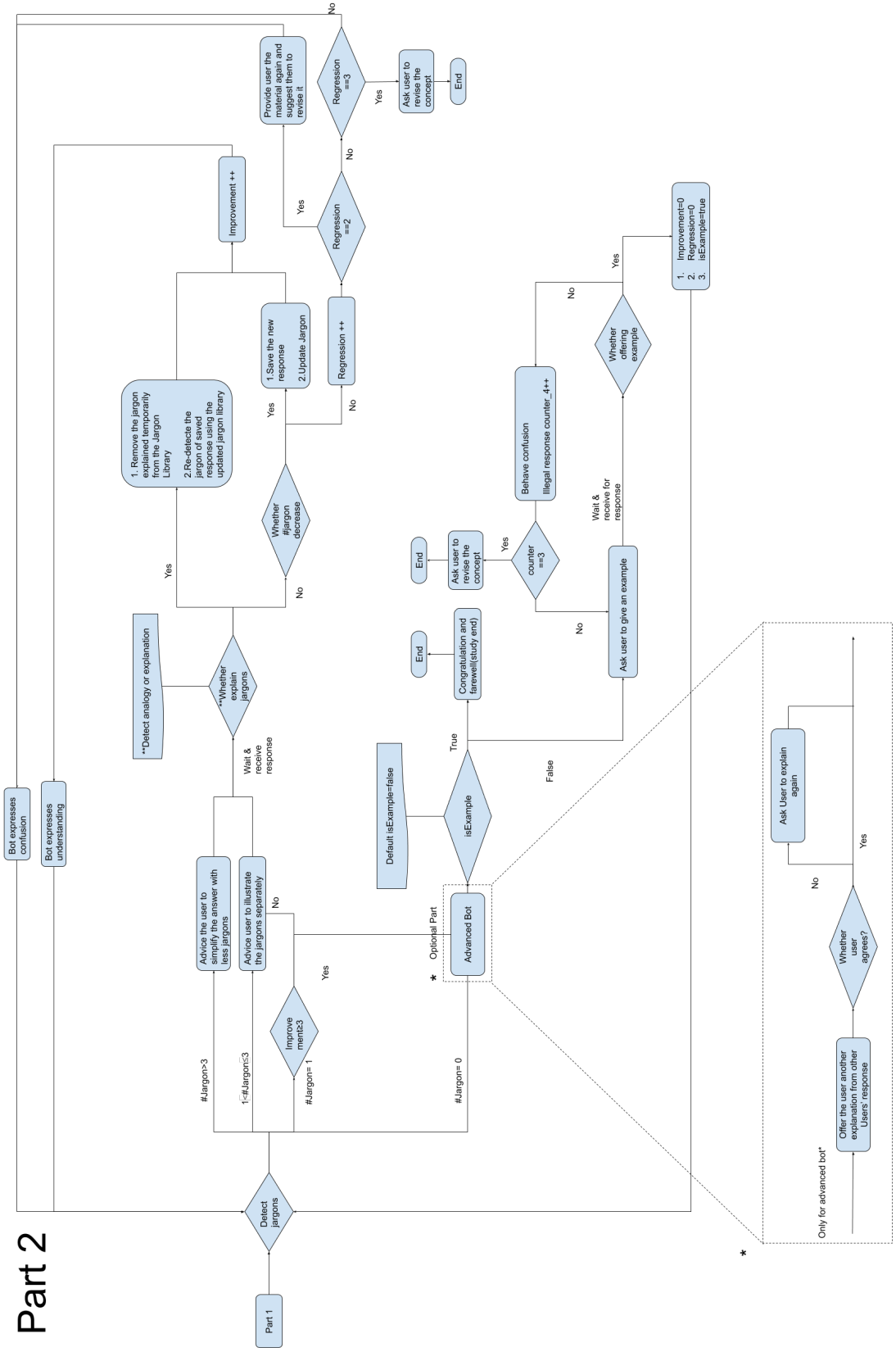
APPENDIX

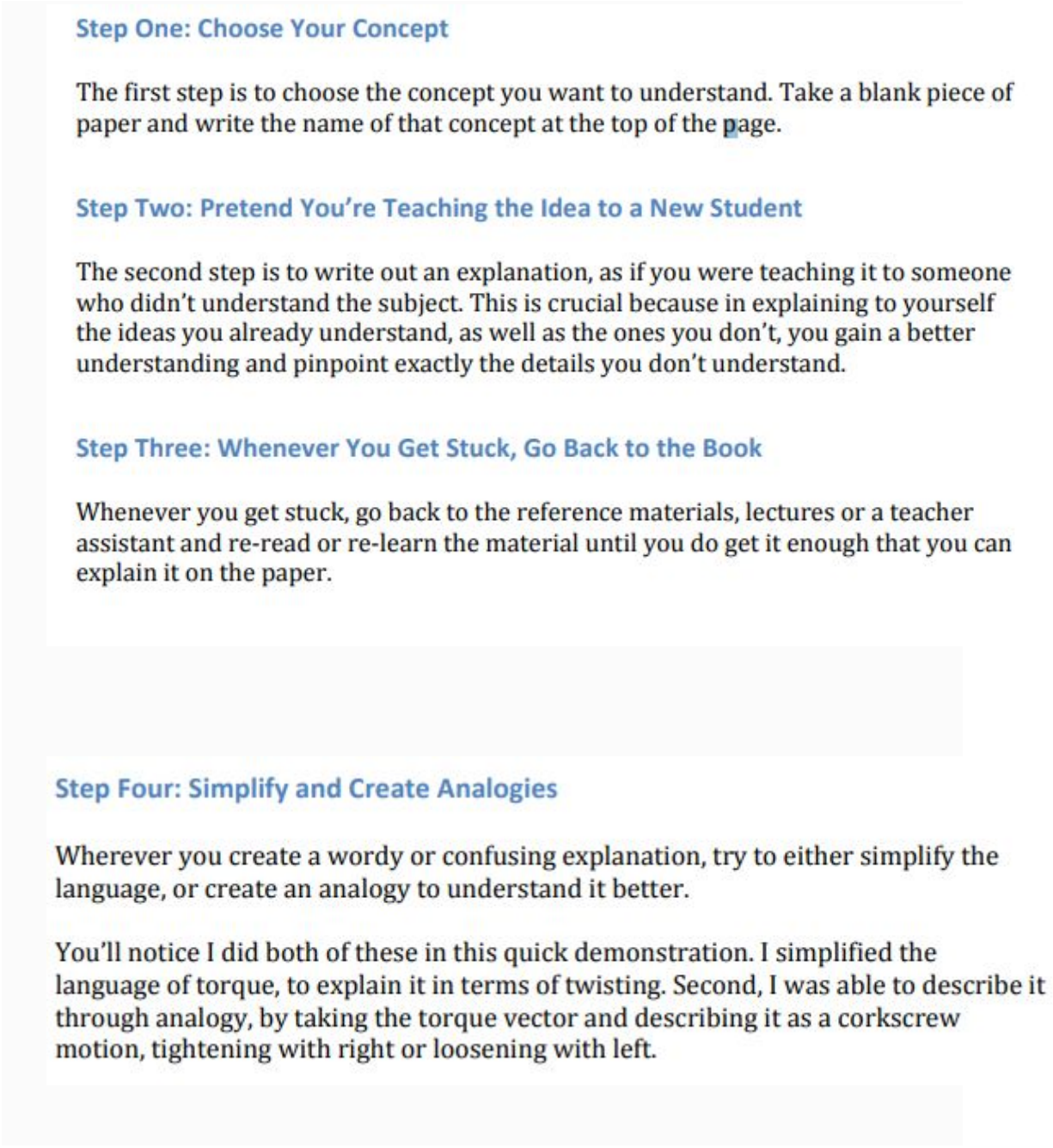
1. The flow chart is shown below.


Part 1
Bot Introduction & Ask for subject
Wait & receive for response
**Whether key words
**Try to match the subject library
Yes
No
List all keywords with numbers
Ask user to choose one of the keywords
Wait & receive response
Whether legal choice
No
Behave confusion
Invalid response counter_1++
counter _1==3
Yes
Suggest user to come back later when he prepare to study
End
Yes
No
1.Store the chosen keyword as the "principle subject"
2. State the beginning of study by asking user to offer explanation
**3. Decide jargon library used in this study according to the "principle subject"
**Assume there are different jargon libraries, each one contains jargons in a certain subject
Wait & receive response
Save received response
Whether offering explanation
No
Behave confusion
Illegal response counter_3 ++
counte _3==3
Yes
Suggest user to come back later to when he prepare to study
End
Yes
Part 2
Remind the user to input sentence with subject they want to study
Illegal response counter_2 ++
counter _2==3
Yes
Ask user to come back later when he wants to study
End
No
1. Chatbot can detect whether user is greeting, if so, it could make simple response andt ask user to go on the study.
2. Chatbot can detect interjection and won't take them as the response. It will keep waiting the user for valid response.
3. Chatbot will explain what should the user do if user express confused about current situation.


Part 2
Part 1
Detect jargons
Bot expresses confusion
Bot expresses understanding
#Jargon>3
1<=#Jargon<=3
#Jargon= 1
#Jargon= 0
Advice the user to simplify the answer with less jargons
Advice user to illustrate the jargons separately
Improve ment≥3
No
Yes
Wait & receive response
**Whether explain jargons
**Detect analogy or explanation
Improvement ++
Yes
1. Remove the jargon explained temporarily from the Jargon Library
2.Re-detecte the jargon of saved response using the updated jargon library
Whether #jargon decrease
No
1.Save the new response
2.Update Jargon
Regression ++
Regression ==2
Provide user the material again and suggest them to revise it
Regression ==3
Ask user to revise the concept
End
Optional Part
Advanced Bot
Default isExample=false
isExample
True
False
Congratulation and farewell(study end)
End
Ask user to give an example
Wait & receive for response
counter ==3
Behave confusion
Illegal response counter_4++
Whether offering example
1. Improvement=0
2. Regression=0
3. isExample=true
Only for advanced bot*
Ask User to explain again
Whether user agrees?
Offer the user another explanation from other Users' response

User Manuals

Introduction about applying Feynman technique



Step One: Choose Your Concept

The first step is to choose the concept you want to understand. Take a blank piece of paper and write the name of that concept at the top of the page.

Step Two: Pretend You're Teaching the Idea to a New Student

The second step is to write out an explanation, as if you were teaching it to someone who didn't understand the subject. This is crucial because in explaining to yourself the ideas you already understand, as well as the ones you don't, you gain a better understanding and pinpoint exactly the details you don't understand.

Step Three: Whenever You Get Stuck, Go Back to the Book

Whenever you get stuck, go back to the reference materials, lectures or a teacher assistant and re-read or re-learn the material until you do get it enough that you can explain it on the paper.

Step Four: Simplify and Create Analogies

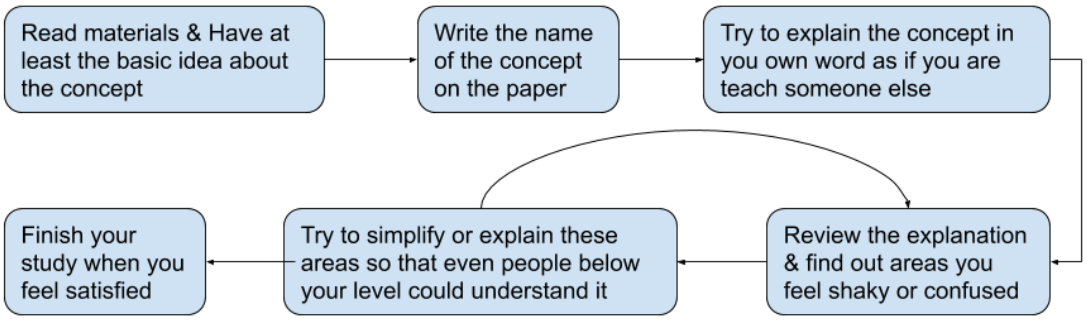
Wherever you create a wordy or confusing explanation, try to either simplify the language, or create an analogy to understand it better.

You'll notice I did both of these in this quick demonstration. I simplified the language of torque, to explain it in terms of twisting. Second, I was able to describe it through analogy, by taking the torque vector and describing it as a corkscrew motion, tightening with right or loosening with left.

Keys when implementing the Feynman technique

1. Please **write down** your explanation.
2. Please explain it as if you are explaining to a **beginner** who barely knows nothing of the concept
3. Please try to explain the concept in **simple** words

4. Please try to **simplify** your explanation as much as you can



*Notice:
You can revise the material anytime during the process

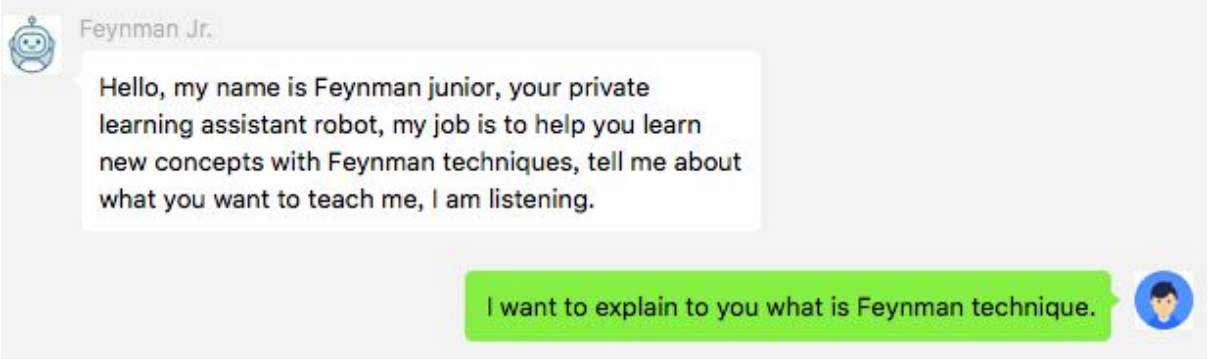
Introduction to our robot

Turing

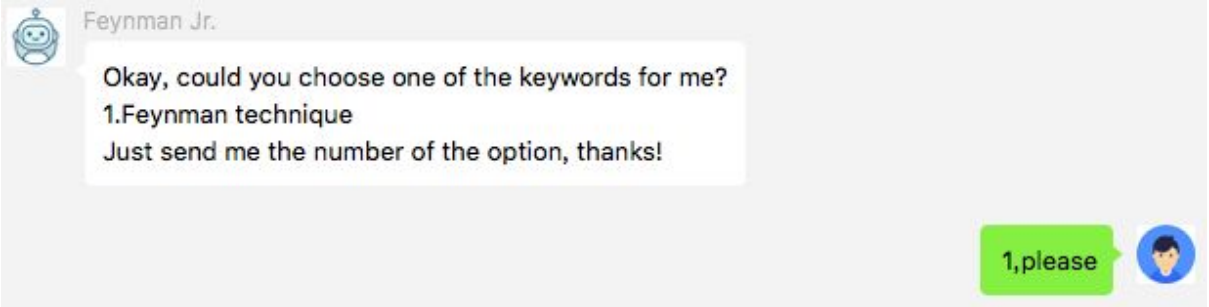
Imagine that our bot is a new student who does not know much about what you are going to teach him. Firstly, the users will try to explain a concept using their own words, and the bot will keep questioning the complex terms that it does not understand well, push the users to modify their explanation by suggesting them to use simpler terms, as well as challenge them to use one example to reinforce their understanding.

How to use it?

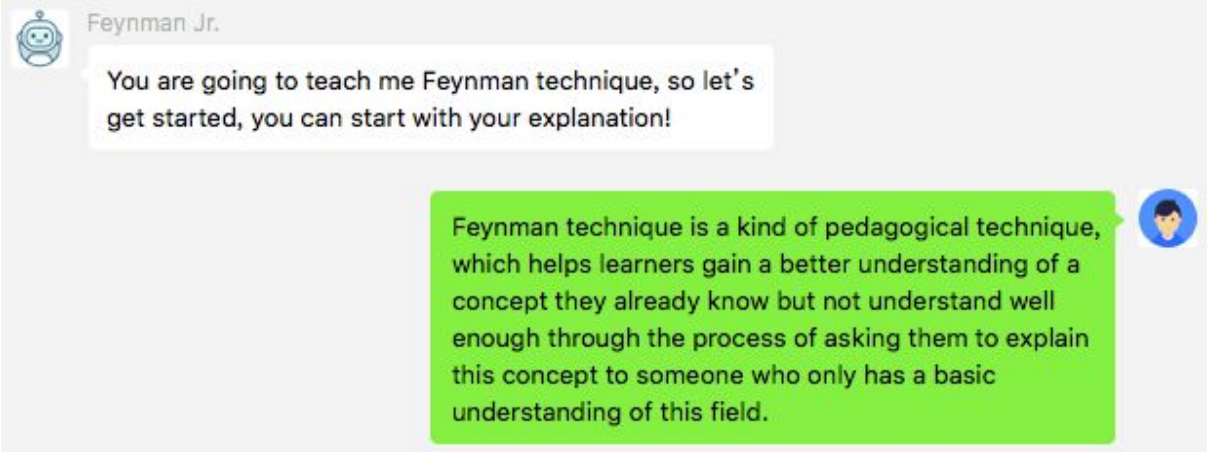
1. The bot will greet in the beginning and ask you the subject that you want to teach. And you need to respond the subject you want to teach.



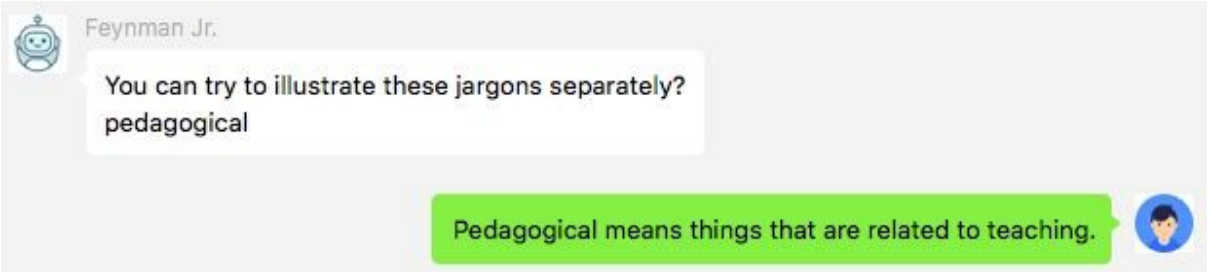
2. The bot will continue to question the keywords with you, you just need to give it the number of your option.

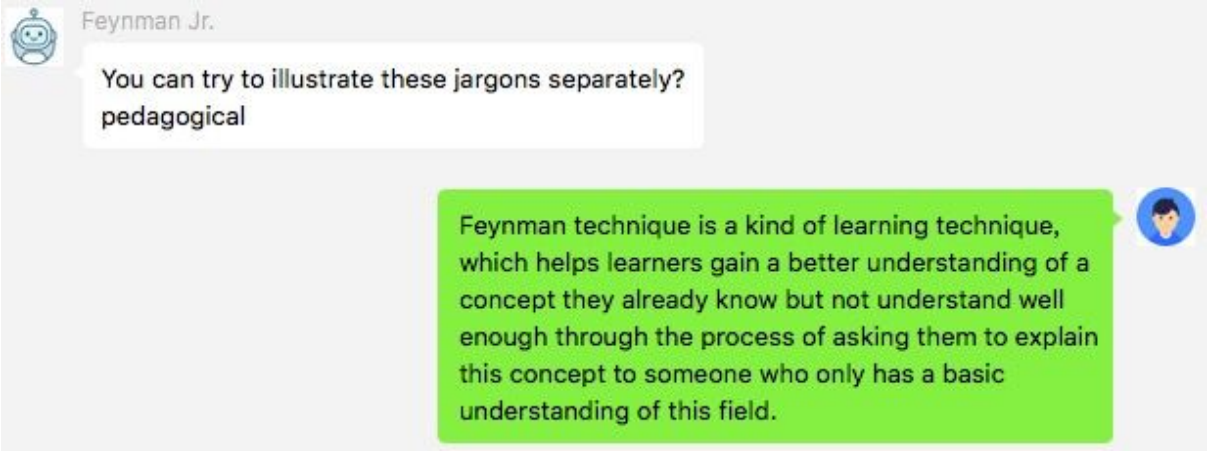


3. The bot will confirm the keyword with you and ask you to start your explanation. You should input your explanation.



4. The bot will suggest that you should try to illustrate the jargons of your explanation. You can either choose to illustrate the jargons or try to rephrase your explanation.





5. Once your explanation achieves a good level. The bot will ask for an example to reinforce your understanding. And the bot will use the same jargons detection technique to push you to improve your example.

Reference

1. Never Forget an Idea Again with The Feynman Technique, Retrieved from https://www.scotthyoung.com/learnonsteroids/grab/TranscriptFeynman.pdf?fbclid=IwAR1Zx1XtOnhrZc8R9UG3-Xau-BRpFtk7UMCZeh-3yjvZCpi1GL_CdjCGkW0

Materials

1. Learning la mise-en-scène

1)Designing the World of Film: Crash Course Film Production #9

https://www.youtube.com/watch?v=Q3BcS8Uwl9U&app=desktop

2) https://en.wikipedia.org/wiki/Mise-en-sc%C3%A8ne

2. ROC curve

1)Classification: ROC Curve and AUC

https://developers.google.com/machine-learning/crash-course/classification/roc-and-auc

2) What is a ROC Curve and How to Interpret It

https://www.displayr.com/what-is-a-roc-curve-how-to-interpret-it/

https://www.youtube.com/watch?v=4jRBRDbJemM

3.Atmospheric circulation

1)Atmospheric circulation

https://content.meteoblue.com/ro/meteoscool/large-scale-weather/atmospheric-circulation

2)Global Atmospheric Circulation

https://www.youtube.com/watch?v=Ye45DGkqUkE

Reference

1.CrashCourse, Designing the World of Film: Crash Course Film Production #9. 26 oct. 2017

2. Classification: ROC Curve and AUC. Retrieved from https://developers.google.com/machine-learning/crash-course/classification/roc-and-auc

3.Carmen Chan, What is a ROC Curve and How to Interpret It, Retrieved from https://www.displayr.com/what-is-a-roc-curve-how-to-interpret-it/

4.Atmospheric circulation, Retrieved from https://content.meteoblue.com/ro/meteoscool/large-scale-weather/atmospheric-circulation

5.Keith Meldahl, Global Atmospheric Circulation. 17 déc. 2011.

Confirmation of Adherence to the ELEC418/518 Ethics Protocol

This form must be completed by each team member and submitted with your project portfolio/reports.

My signature below indicates that I have read the EECE418/EECE518 Ethics Protocol and have abided by it throughout my class project.

Name	Signature	Student Number	Date
Zixuan Tan	Tan Zixuan	85378503	2019.12.9
Sizhuo Qi	Sizhuo Qi	65424632	2019.12.9
Xiaoan Sun	Xiaoan Sun	79879938	2019.12.9

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Electrical & Computer Engineering
2332 Main Mall
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December 6, 2019

Sample Consent Form (no videotaping)

Human-Computer Interaction Course Projects (CPEN 441/541)

Principal Investigator

Dr. Sidney Fels, Professor, Department of Electrical and Computer Engineering, University of British Columbia (604) 822-5338

Student Investigators

QI, SIZHUO (236)863-6459
SUN, XIAOAN (778)871-8172
TAN, ZIXUAN (778)325-2018

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Confidentiality

The identities of all people who participate will remain anonymous and will be kept confidential. Identifiable data will be stored securely in a locked metal filing cabinet or in a password protected computer account. All data from individual participants will be coded so that their anonymity will be protected in any project reports and presentations that result from this work.

Remuneration/Compensation

We are very grateful for your participation. However, you will not receive compensation of any kind for participating in this project.

Contact Information About the Project

If you have any questions or require further information about the project you may contact Dr. Sidney Fels (604) 822-5338.

Contact for information about the rights of research subjects

If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598.

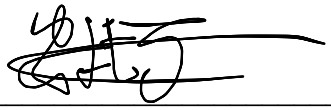
Consent

We intend for your participation in this project to be pleasant and stress-free. Your participation is entirely voluntary and you may refuse to participate or withdraw from the study at any time.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, Antoine Portet, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

Participant's Signature	Date
	7/12/2019

Tan Zixuan Sizhuo Qi Xiaoan Sun 2019/12/07

Student Investigator's Signature Date

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Electrical & Computer Engineering
2332 Main Mall
Vancouver, B.C., V6T 1Z4

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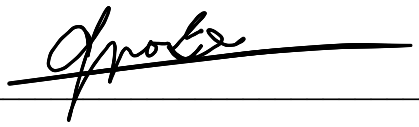
Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, Quentin Portet, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

Participant's Signature	Date
	7/12/2019

Tan Zixuan Sizhuo Qi Xiaoan Sun 2019/12/7

Student Investigator's Signature Date

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Department of Electrical & Computer Engineering
2332 Main Mall
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Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, Lucas Xie, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

Lucas Xie 12.5.2019

Participant's Signature Date

Tan Zixuan Sizhuo Qi Xiaoan Sun 2019.12.5

Student Investigator's Signature Date

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Department of Electrical & Computer Engineering
2332 Main Mall
Vancouver, B.C., V6T 1Z4

December 6, 2019

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Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, _____, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

12/06/2019

Participant's Signature Date

Tan Zixuan Sizhuo Qi Xiaoan Sun 2019/12/6

Student Investigator's Signature Date

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Computer Science
2332 Main Mall
Vancouver, B.C., V6T 1Z4

December 6, 2019

Sample Consent Form (videotaping included)

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Although only a course project in its current form, this project may, at a later date, be extended by one or more of the student investigators to form the basis of his/her thesis research.

Confidentiality

The identities of all people who participate will remain anonymous and will be kept confidential. The one exception is that excerpts from the videotape may be presented as described above, and your identity may be revealed through those video excerpts. Identifiable data and videotapes will be stored securely in a locked metal filing cabinet or in a password protected computer account. All data from individual participants will be coded so that their anonymity will be protected in any reports, research papers, thesis documents, and presentations that result from this work.

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Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, Zhihui Lu, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

Zhihui Lu 2019.12.7.

Participant's Signature Date

Tan, Zixuan Sizhuo Qi Xiaoan Sun 2019.12.7

Student Investigator's Signature Date

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Electrical & Computer Engineering
2332 Main Mall
Vancouver, B.C., V6T 1Z4

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I, Shilang Xiong, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

2019.12.6

Participant's Signature Date

Tan, Zixuan SIZUO Qi Xiaoan Sun 2019.12.6

Student Investigator's Signature Date

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Project Purpose and Procedures

This course project is designed to investigate how people interact with certain types of interactive technology. Interactive technology includes applications that run on a standard desktop or laptop computer, such as a word processor, web browser, and email, as well as applications on handheld technology, such as the datebook on the Pocket PC, and also applications on more novel platforms such a SmartBoard (electronic whiteboard) or a Diamond Touch tabletop display.

The purpose of this course project is to gather information that can help improve the design of interactive technology. You will be asked to use one or more forms of interactive technology to perform a number of tasks. We will observe you performing those tasks and analyze how the technology is used. You may be asked to complete a number of questionnaires and we may ask to interview you to find out your impressions of the technology. You will be asked to participate in at most 3 sessions, each lasting no more than 1 hour.

Although only a course project in its current form, this project may, at a later date, be extended by one or more of the student investigators to form the basis of his/her thesis research.

Confidentiality

The identities of all people who participate will remain anonymous and will be kept confidential. Identifiable data will be stored securely in a locked metal filing cabinet or in a password protected computer account. All data from individual participants will be coded so that their anonymity will be protected in any project reports and presentations that result from this work.

Remuneration/Compensation

We are very grateful for your participation. However, you will not receive compensation of any kind for participating in this project.

Contact Information About the Project

If you have any questions or require further information about the project you may contact Dr. Sidney Fels (604) 822-5338.

Contact for information about the rights of research subjects

If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598.

Consent

We intend for your participation in this project to be pleasant and stress-free. Your participation is entirely voluntary and you may refuse to participate or withdraw from the study at any time.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this project. You do not waive any legal rights by signing this consent form.

I, Jack Yang, agree to participate in the project as outlined above. My participation in this project is voluntary and I understand that I may withdraw at any time.

Jack Yang — Dec 7.2019
Participant's Signature — Date

Tan, Zixuan Sizhuo Qi Xiaoan Sun 2019.12.7

Student Investigator's Signature Date

PANEL ON
RESEARCH ETHICS

Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Zixuan Tan

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **9 December, 2019**