Title: A web-application for students to arrange voluntary tutoring for children

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Abstract:

There are over a million people in the UK for whom English is not their first language (White, 2013). For many of those people, difficulties reading and writing in English are an obstacle to involvement in their children’s education (Carr-Hill *et al.*, 1996). Having achieved exam success, some university students – many of whom are bilingual international students – are in a position to volunteer as tutors for families whose first language is not English.

We propose to build a web application for connecting parents in the UK, whose primary language is not English, with volunteer tutors. We produced high and low fidelity prototypes based on secondary research into user interface design for low-literacy users, and analysis of tutoring applications already available. Through testing our prototypes with users and stakeholders, we will adjust our designs - based on their feedback - before commencing the build stage.

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Mission statement

The UK has many residents whose first language is not English. Traditionally, parents help their children with homework, but this is extremely difficult for parents who live in the UK and do not have a strong grasp of English. Hiring private tutors is expensive and such parents have limited alternatives for helping their children with homework. We plan to build a web application for parents – who have a limited grasp of English – to find university students who can help explain the homework for the parent and their child.

Problem identification

Reporting on the 2011 UK census, the Office for National Statistics stated that 1% of households had no adults - but at least one child - who spoke English as their first language and 4% of households had no residents at all whose first language was English (White, 2013). Those percentages equated to 182,000 households without an adult whose primary language was English and 1 million households without any residents whose primary language was English (White, 2013).

Tes is a worldwide educational services company, born out of The Times Education Supplement, a periodical pull-out from Britain’s Times newspaper. According to Tes (we were unable to locate the source data), a YouGov survey found that almost 70% of teachers were worried that parents of pupils whose first language is not English could not help their children with homework (Henshaw, 2018). Department for Education data from 2018 showed that English was not the first language for 21.2% of primary school children and 16.6% of secondary school children (Department for Education, 2018). Therefore, teachers believed the parents of more than a fifth of primary school students - and more than a sixth of secondary school pupils – could not help them with their homework. Numbers of primary and secondary school pupils for whom English is not their first language increased to 21.3% and 17.1% respectively in the 2019-20 year (Department for Education, 2020).

The ‘Basic Skills Agency’ was a British government funded think-tank which researched strategies for improving standards of numeracy, literacy and ‘English for Speakers of Other Languages’ amongst UK residents. They published a report in 1996 titled *Lost Opportunities: The Language Skills of Linguistic Minorities in England and Wales*. The report concerns levels of English language proficiency amongst Bengali, Chinese, Punjabi, Bosnian, Kurdish and Tamil communities living in England and Wales. The report found many adults from those groups have “very limited English communication skills and so have only a limited capacity to […] facilitate the education of their own children” (Carr-Hill *et al.*, 1996). It also found that more than third of Bengali and Punjabi speakers were unable to even read a child’s school timetable in English.

Later, the British government commissioned a working group to research the needs of adults in the UK for whom English is not their first language. The group was led by Sir Claus Moser, head of the BSA and published a report titled *Breaking The Language Barriers*. This elaborated on the *Lost Opportunities* report and suggested again that lack of English fluency might limit parents’ “ability to be involved with and support their own children’s education” (Working Group on English for Speakers of Other Languages, 2000). This report includes the case study of a Bangladeshi woman who had lived in the UK for seven years, never had any English language lessons and could not read or write in English. She had “2 children who attend primary schools but has very little contact with agencies such as the school and the health services because of her lack of English”.

The Bell Foundation is a charity which aims to reduce language barriers to education (*About Us - The Bell Foundation*, no date). English as an Additional Language (EAL) is a common term for learning English in addition to one’s native language, particularly applied to children. Academics from Anglia Ruskin University and the University of Cambridge published a report in 2016, funded by The Bell Foundation, titled *Language Development and School Achievement: Opportunities and challenges in the education of EAL students*. The study used a sample of parents and children from two schools with high proportions of pupils for whom English is not their first language. Asked about barriers to helping their children with homework, the “vast majority of parents at Kirkwood Academy mentioned English language” (Evans *et al.*, 2016:53).

Gathered Together was a project undertaken by the Scottish Parent Teacher Council and BEMIS, a public body which supports ethnic minority charities in Scotland. One report they published was titled *Experiences of Parental Involvement Among Families From Ethnic Minorities*. Reporting on their studies, they stated “many parents expressed concern that they were not able to support their children with homework—often due to lower levels of English” (Gathered Together, no date: 4).

Clearly, for many British residents whose first language is not English, poor levels of English literacy are a barrier to helping children with their homework. We can also demonstrate that there are undergraduate students who want to volunteer as tutors for disadvantaged schoolchildren.

JACARI is a charity founded by University of Oxford students, which has a history of undergraduates voluntarily tutoring schoolchildren (Deer and Avery, 2012) and testimonials on its website describing voluntary tutoring as “the most rewarding thing I have done at university” (*Volunteer | Jacari!*, 2020). The Access Project is another British charity whose mission is to “support students from disadvantaged backgrounds to access top universities, through a unique combination of tuition and in-school mentoring” (*What We Do - The Access Project*, no date). They only accept university students or graduates as tutors (*Become a volunteer tutor - The Access Project*, no date).

Stakeholders’ and users’ needs

Studies have found that low-literacy users of a digital device or system are most likely to complete a task when the system has a graphical interface, but they need less external help and finish tasks faster when there is a spoken interface (Medhi *et al.*, 2011). Since the aim is to help parents whose first language is not English our application must use visual (rather than verbal) cues as extensively as possible. It should be noted that the cited study by Medhi et al. worked with participants who were not literate in their native languages, whereas our users may be literate in their primary languages but not in English. Parents should be able to switch the application’s language to their primary language when they first register.

Chaudry et al. (2012:8) found that user task completion is better when the number of steps to complete the task is minimised, suggesting that five to ten steps may be optimal. They also found that their low-literate participants all managed to use graphical interfaces and particularly preferred the use of radio buttons, where appropriate. Their participants particularly appreciated UIs with a home button, which “helped them recover from mistakes easier by providing them with a recognizable point to restart the task gone wrong” (Chaudry *et al.*, 2012:7). Including a ‘back’ button in processes helps users to correct mistakes on recent screens (Chaudry *et al.*, 2012:9).

All functions which require input from a parent should be able to receive input as either speech or text and (if not in English) translate to English. Speech input should be transcribed to text – using their device’s microphone and dictation or speech-to-text functionality – before translation.

With the volunteer tutors being university students, we will need working partnerships with universities and access to their databases/student ID systems such as Shibboleth. This is necessary for security purposes and accountability in the case of trouble.

We will need students to volunteer their time for tutoring and in return, they will want some recognition for their efforts. This may entail us working with university student services to provide feedback for student HEARs (Higher Education Achievement Reports).

Other beneficiaries may be schools with pupils whose first language is not English, expatriate community groups in the UK and charities (such as those mentioned in the ‘problem identification’ section above) whose mission is to improve inclusivity in the British education system.

Owing to several changes of direction for this project, we have yet to directly communicate with stakeholders. Hence, before commencing the building stage of development, we will test our high-fidelity prototypes with stakeholders and collect feedback. The feedback will be used to make any necessary design changes for the next iteration.

User persona

Graphical user interface, text, application, chat or text message

Description automatically generated

Functional specification

Initial list of necessary features for the MVP (to be revised based on surveys and interviews):

* Parents login/create account (check against & add to a database of users)
* Students login (Shibboleth)
* Tutors using the app for first time create a brief profile (e.g. name, age, subjects they can tutor for)
* Parents create basic profile with their name and first language (info which tutors will need). Options to elaborate with further profile info if desired, but not mandatory, considering they struggle with written English
* Parents post requests for help with children’s homework – voice or text input, translate from their first language if not in English
* Tutors browse requests for tutoring
* Tutors reply to requests to offer tutoring
* Messaging feature to arrange logistics of the tutoring – voice or text messages with translation
* Feedback (parent can tell others whether the tutor was friendly, respectful, punctual and helped as necessary) – optional, considering difficulties with written English. Optional star rating and optional comments field with voice/text input and translation

Market/competitor analysis

We did not find any applications explicitly targeting homework assistance at parents and children for whom English is not their primary language. However, there are many applications for generally seeking tuition and help with homework, without an integrated translation service.

Peer Tutor:

Peer Tutor (*PeerTutor.com*) is an app for British secondary school children to seek and receive help with homework. Its average ratings on Apple App Store and Google Play Store are 4.2 and 4.7 respectively; very respectable, though based on very few ratings (24 and 15 respectively) (*‎Peer Tutor on the App Store*, 2020; *Peer Tutor – Apps on Google Play*, 2020). All questions and answers posted through the Peer Tutor app are moderated by AI software, which is an interesting safety/security feature.

Posting a question is relatively straightforward. Either by tapping the big ‘new question’ button from the main screen and then choosing a subject or tapping a subject and then ‘new question’. Users can upload pictures from their device or open its camera interface to take a picture. There is a text entry field, which has the option of using speech dictation too. It transpires there is no way to edit or delete a question, once asked. Consequently, if a user asks a question and subsequently wants to change it, their only option is to ask another Also, the question I asked ended up in the ‘university life’ section, although I chose Engineering as the subject.

Asking a question through Peer Tutor:

Graphical user interface, application

Description automatically generated Graphical user interface, application

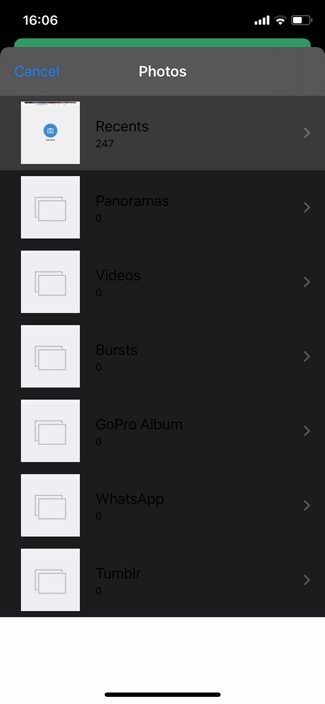
Description automatically generated Graphical user interface, application

Description automatically generated Graphical user interface, text, application

Description automatically generated

Graphical user interface, application

Description automatically generated Graphical user interface, application

Description automatically generated  A picture containing text, different, various, same

Description automatically generated

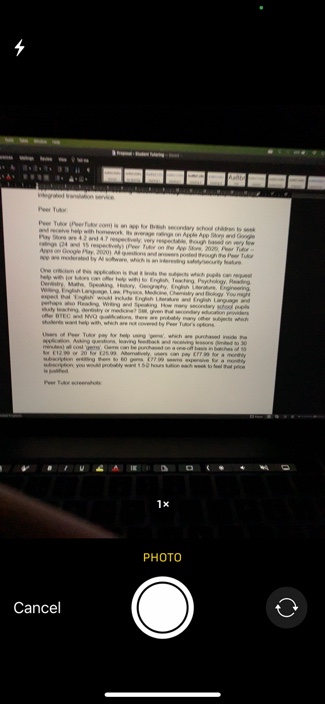
Graphical user interface, application

Description automatically generated Graphical user interface, application, website, Teams

Description automatically generated Graphical user interface

Description automatically generated Graphical user interface, application

Description automatically generated

 A picture containing text, indoor, electronics, black

Description automatically generated Text

Description automatically generated

One criticism of this application is that it limits the subjects which pupils can request help with (or tutors can offer help with) to: English, Teaching, Psychology, Reading, Dentistry, Maths, Speaking, History, Geography, English Literature, Engineering, Writing, English Language, Law, Physics, Medicine, Chemistry and Biology. You might expect that ‘English’ would include English Literature and English Language and perhaps also Reading, Writing and Speaking. How many secondary school pupils study teaching, dentistry or medicine? Still, given that secondary education providers offer BTEC and NVQ qualifications, there are probably many other subjects which students want help with, which are not covered by Peer Tutor’s options. We can avoid this pitfall by having the requesting user explicitly specify (by input) which subject the question concerns, rather than choosing from a list.

Users of Peer Tutor pay for help using ‘gems’, which are purchased inside the application. Asking questions, leaving feedback and receiving lessons (limited to 30 minutes) all cost ‘gems’. Gems can be purchased on a one-off basis in batches of 10 for £12.99 or 20 for £25.99. Alternatively, users can pay £77.99 for a monthly subscription entitling them to 60 gems. £77.99 seems expensive for a monthly subscription; you would probably want 1.5-2 hours tuition every week to feel that price is justified.

Brainly:

Later in the project proposal stage, we found Brainly, which might have been a better competitor to analyse than Peer Tutor. Due to time constraints, we have not managed to make an analysis of it.

Peer Tutor general UI:

Graphical user interface

Description automatically generated Graphical user interface, application

Description automatically generated Graphical user interface, application

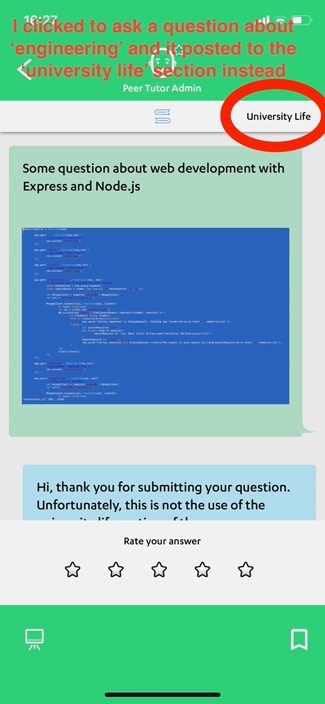
Description automatically generated Graphical user interface, application

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Graphical user interface, application

Description automatically generated Graphical user interface, application

Description automatically generated Diagram

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Yourtime:

Yourtime is an application for arranging peer-to-peer mentoring for British university students. Its average ratings on Apple App Store and Google Play Store are 3.3 and 3.8 respectively (*‎Yourtime co on the App Store*, 2020; *Yourtime – Apps on Google Play*, 2020). Clearly many prospective users are disappointed with it – most of the negative reviews mention that only students from some British universities are able to register. We have no way of knowing how many of those negative reviewers were attempting to register as tutees and how many as tutors. However, we should ensure that students from all British universities are able to register.

Use case diagram: Parent requesting tutoring for their child

Diagram

Description automatically generated

Use case diagram: Tutor offering homework help for children and their parents

Diagram

Description automatically generated

UML Diagrams

Registration activity diagram:

Diagram, engineering drawing

Description automatically generated

Login activity diagram: Diagram

Description automatically generated

Request tutoring activity:

Diagram

Description automatically generated

|  |  |
| --- | --- |
| Tutors viewing/replying to requests: | Messaging activity: |
| Diagram  Description automatically generated | Diagram  Description automatically generated |

Class diagrams (incomplete)

Diagram

Description automatically generated

Low-fidelity prototypes

|  |  |
| --- | --- |
| Obraz zawierający tekst  Opis wygenerowany automatycznie | Obraz zawierający tekst  Opis wygenerowany automatycznie |
|  | Obraz zawierający tekst, paragon, dokument  Opis wygenerowany automatycznie |
| Obraz zawierający tekst  Opis wygenerowany automatycznie | Obraz zawierający tekst  Opis wygenerowany automatycznie |
| Obraz zawierający tekst, paragon  Opis wygenerowany automatycznie |  |

High fidelity prototypes

Hi-fi prototypes are being developed in Adobe XD, with the following additional plugins: Icons 4 Design (for icons); UI Faces (anonymous user profile images); uilogos (for flags).

The pages are kept relatively plain and clear, so that users with low levels of English literacy are not distracted by clumps of text they cannot read, or lots of superfluous graphics/icons and colours. Contrasting light and dark colours are used for clarity. The colour blue was chosen because it supposedly represents coolness, peace and confidence; we want users to feel reassured and as stress-free as we can manage. Sans-serif fonts – such as Arial – are used to maximise legibility (particularly for the sake of dyslexic users) and font size is quite large. Flag icons are to make it clear to users they are picking their language. Likewise, in the create request and messaging functions, icons are used to reinforce/clarify to users what is happening.

We need to further expand the XD prototypes with overlays and step-by-step transitions/animations/click-throughs for whole activity processes, such as registering and logging in and asking for help and messaging etc. This is necessary for showing users something coherent when we get to testing; otherwise it will be extremely confusing for them.

Home/landing page:

Graphical user interface, application, Teams

Description automatically generated

Parent registration:

Graphical user interface, application

Description automatically generated

Parent create request for help page:

Graphical user interface, application, Teams

Description automatically generated

Messaging:

Graphical user interface, application

Description automatically generated

Leaving feedback for tutors:

Graphical user interface, application

Description automatically generated

Editing a profile:

Graphical user interface, application, Teams

Description automatically generated

Tutor registration:

Graphical user interface, application

Description automatically generated

Tutor viewing requests for help:

Graphical user interface, application

Description automatically generated

FAQ page about the application:

Graphical user interface, application, Teams

Description automatically generated

Resources used in these prototypes:

German flag:

<https://upload.wikimedia.org/wikipedia/en/thumb/b/ba/Flag_of_Germany.svg/1200px-Flag_of_Germany.svg.png>

French flag:

<https://upload.wikimedia.org/wikipedia/en/c/c3/Flag_of_France.svg>

UK flag:

<https://upload.wikimedia.org/wikipedia/en/thumb/a/ae/Flag_of_the_United_Kingdom.svg/1200px-Flag_of_the_United_Kingdom.svg.png>

Lorem impsum generator:

<https://loremipsum.io/generator/?n=5&t=p>

Technical architecture

We decided to make our application a browser-based, progressive web application. The advantage of this over a platform-specific native application is that it will run on any device with an internet connection and a web browser. It will be built using a combination of HTML, CSS, JavaScript, Express, Node.js and SQL. Using CSS, we can optimise the design to render nicely on mobile displays and have extra rules to render it properly on larger displays.

These decisions are largely due to our own programming competencies and the devices we have access to. We all have (at least) an academic year’s experience of JavaScript, HTML and CSS. Some group members have only two or three months experience of Java programming and all of us use iPhones, so coding an Android app in Java makes little sense for us. On the other hand, 3/5 of us own MacBooks, so the other two members would have serious difficulties if we had chosen to develop in Swift/Objective C.

Naturally, it may be disadvantageous that users will need to open a browser and visit the URL, as opposed to a ‘native’ (iOS or Android) application which opens by tapping an icon and is immediately ready to use. We can offset that disadvantage by encouraging users to create a bookmark shortcut on their homescreen or desktop.

Technical specifications (incomplete)

* Shibboleth login/ID verification.
* A translation API – Google (costs money), Bing, Yandex, Systran.io or other?
* Dictation/speech to text – built in device functionality?
* HTML files for pages.
* index.js file for the Express application and database connection.
* main.js file for the routing, handling get and post requests etc.
* CSS stylesheet with rules so to render the app correctly on mobile/tablet displays as well as desktop.
* SQL database for user records

Ethical audit

Data protection (tutors):

We have yet to properly establish how exactly Shibboleth functions, despite time spent reading the information on their website. Student tutors will register and login using Shibboleth to verify that they are genuine university students. It appears this will require us to have some access to universities’ student databases. We are unsure whether the login verification will require us to store their credentials, or whether Shibboleth’s interface merely request the credentials are input and checks them against universities’ databases itself, without us directly having the usernames and passwords.

Besides the login credentials, our application has no functional need to collect data from the tutors which is particularly sensitive. In the event of a data breach, the data exposed will be of very limited use to anybody.

Date protection (parents):

The data we collect about parents is kept to a minimum. It is possible for them to use our application having provided only their name and primary language (other profile fields are optional). Other data held about parents is not of a sensitive nature: our application has no functional need for dates of birth, ages, precise locations or financial data. Therefore, in the event of a data breach, the data exposed is of very limited use to anybody.

Security:  
  
Connecting children with adults who are strangers to them exposes those children to safety risks. Clearly, we do not want to enable or facilitate any form of inappropriate contact or abuse. We have a two-pronged approach to minimising that risk.

First, our application is intended to benefit the parents as well as their children, so we require tutors to agree to provide tuition to the child and their parent together. The parents will also have to agree to attend lessons alongside their child. Users can report violations of this procedure to us and offenders will be banned from the application. The children can translate and relay relevant or important information about the homework to their parent in their primary language, if the parent is unable to understand written English.

Second, tutoring should be delivered remotely, digitally through a third-party application such as Discord (free to use). Our application is for making logistical arrangements for tutoring. Hence the tutor and child are not physically in the same location and the parent is present, so there is little scope for anything inappropriate. This is not a foolproof guarantee of safety, since it relies on all users to adhere to our policy. However we are taking reasonable steps to minimise the risk.

Evaluation strategy

Naturally we want to build an application which is helpful for our target demographic and which people will actually use. Otherwise, the project is an exercise in futility. Therefore, we will engage our stakeholders to provide feedback on our designs and our minimum viable product, once built. Designs will be adjusted as part of our iterative design process. Feedback will be collected using a short survey (powered by Google Drive forms) - to identify users most likely to benefit from the application – followed by interviews. Interviews may be conducted through email or audio/video chat on Discord.

Ideally prototypes would already have been tested during the proposal stage, but due to several changes in the project’s direction, low-fidelity prototypes were not prepared with sufficient time for testing and high-fidelity prototypes are still in progress. We have allocated two five-day periods – in our project Gantt chart – for user testing high-fidelity prototypes. A week has been allocated for design adjustments after each five-day testing period.

We see no reason why design changes cannot be undertaken simultaneously with the code development; the application needs to integrate translation and speech input regardless. Visual styling and the graphical interface will be largely CSS based and we plan the CSS coding for towards the end of development. If we have properly tested and collected useful feedback from our hi-fi prototypes earlier in development, we will be well informed about how we can style the application to be as clear and appealing for users as we can.

Language barriers are likely to be a major challenge for our testing and feedback. We have yet to directly communicate with any prospective users, so we do not know which languages they primarily speak. We cannot realistically create prototypes in many languages, though our group has members whose primary languages are Polish and Somali, so we may produce some in those languages in addition to English. That does not help us connect with users who are not literate in English and also do not speak Polish or Somali. Likewise, these problems apply to surveys and interviews, though translating surveys should be relatively straightforward. Interviews conducted by email afford some scope for translation and if we choose to use audio/video chat instead, that will be because the interviewee has some confidence in English speaking and listening.

Two weeks in March are allocated to user testing our minimum viable product. Tests need to be very thorough and to investigate what happens when users interact with the application in unexpected ways – that is how we will identify bugs and design flaws. The subsequent three weeks are allocated for debugging, then the final six days are allocated for a final round of user testing.

Given the challenges of language barriers, our final evaluation strategy will be informed by what we learn from testing the prototypes and MVP. The ideal way of conducting final testing is asking users to accomplish particular tasks using the application and interviewing them about how successful they managed those tasks. Users will be observed whilst attempting the tasks; observers will record details such as how long it took to accomplish the task, whether they managed it without asking for external help, how many clicks or taps it required, how many times they requested help (if applicable), how many failed attempts were made before the user successfully completed the task. Interviews will ask whether users found the task frustrating and why, what could be made clearer, which present information or prompts are unnecessary, whether anything is missing a prompt or explanation which would have helped. Finally, we will perform some statistical analysis and report the findings.

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