GROUP ASSIGNMENT COVER SHEET

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Course: INFS3634

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Assignment Title: INFS3634 T2 2023 Group Assignment

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Contents:

Executive Summary

The following report outlines the process of creating an educational application supporting the wider UNSW community. A spanish language app, Aprender, was designed encompassing features of structured learning lessons, gamification elements, testing, multimedia content and notes catering to students wishing to learn Spanish. The motivation behind this topic was due to the growing prevalence of Spanish as a global language and the importance of providing an effective platform to assist students on their Spanish speaking journey.

The steps employed to develop this app include project ideation, UI Design Prototyping and App Development. A divergent thought process was utilised to brainstorm a variety of ideas before settling on key design features to include in the app, app functionality and best practices in app development. Low fidelity and high fidelity mockups were designed during different stages of the app development to converge ideas, with intents, adapters, firebase integration and API queries utilised as part of the application development process of Aprender.

Requirement 1 - Project Ideation

Educational Data Available Online

Educational data on a wide variety of topics such as science, politics, sports and language etc, is widely available online through various officially published sources such as government data, company data and through independent sources. Our application will utilise an API to gather educational data from an existing application and utilise it on our own mobile application, potentially for a differing purpose. APIs are known as Application Programming Interfaces, and allows the user (of the application) to interact with the app through information gathered from other sources feeding into the app. As such, data within the application is gathered from secondary sources and is utilised in the back end to facilitate the application.

API Functionality

The API facilitates an application as it is code and data used by another application when programming their app. As such, to ensure that the API is fit for building our team's mobile applications, we must ensure that the UI of our desired app connects to the API code. The UI components must match, or else the application will not run as it will fail to recognise components that the API is referring to, or conversely UI components within our UI will be unused.

The API works by connecting to the back end of our application wherein data will pass through the UI then the API. The API acts as a doorway to allow third party integration into the existing application. Our teams mobile application then will use the API to then request data from an existing application (built off of the language translation topic)

This works by the mobile app sending a series of get requests to the existing application to gather data from it. Subsequently, the application receives this request and responds with the requested data being sent to the mobile app in a JSON file format. The JSON file contains the data values required to plug into the backend of the application and support the educational database we will use. After which, our group will then take this data from API in a JSON file format and program it into our mobile app to design it into a functional and aesthetic user interface design.

API Ideation and Selection

After considering the below (figure 1) API integrations to include in Aprender for the purpose of translating Spanish to English, our group chose MLKits*("Translation | ML Kit")*. This was mainly due to its advantage of being open source and highly accessible to us through their website. Additionally, no authentication for an API key was required to request API documentation. The lengthy setup and complicated login process of the other two translator APIs were something that was largely disadvantageous for us. Although Google Translation Hub *("Translation Hub")* and Microsoft *("Translator Text API")* were highly accurate due to their sophisticated high fidelity machine learning technology, the purpose of the basic learning app did not require such extra

functionalities, as MlKits provided a sufficient translation service as well whilst still using machine learning . Additionally, an implementation guide step by step made Integration into Aprender an easy process. Being as this was an educational app for students, such sophisticated models present in Microsoft and Google Clouds API system were not required, unnecessary for the target audience- making MLKits the correct API for Aprender.

API Name	Description and Functionalities	Advantages	Disadvantages
Google Cloud Translation API - "the Translation Hub"	o Is a reliable translation service that hosts a wide variety of languages o Is a subscription based paid system where users will need to sign in, setup account and pay for translation services	o Hosts a wide variety of languages o Can start free trial with existing google account o Accurate translations due to Google's advanced Machine Learning	o Pricing- Requires payment for some services o Set up - Lengthy set up process to gain access to account o API Key - Requires an API key for authentication
LibreText	o Is an open Source Machine Translation API able compatible with Java language o Is able to detect any language, understand the inputted language and translate back to English/ Spanish	o Open Source - Is open source, source code widely available on Github o Compatibility - Compatible with Java language ad android studio o Easy to set up	o Accuracy - Translations may not be as accurate due to some reliance on community contributions o Relies on developer customisation as its a rough framework
Google MLKits	o Is an On device Translation API that utilises machine learning to actively translate up to 50 languages to and from English o Is also developed by Google but is a lower Fidelity model of "The translation Hub".	o Range - Supports a broad list of languages o Easy Implementation - Documentation on integration widely and available and easy to implement o Accurate Translations	o Lower Fidelity- than Google and Microsoft o Accuracy - Intended for simple translations
Microsoft Azure Translation	o Uses modern NMT services to provide an accurate and reliable translation service compatible with many operating systems and softwares o Has a wide variety of languages to detect, translate and respond with	o Highly customisable - Is able to be integrated onto many platforms o Highly accurate due to Neural Machine Translation o Has a free User Tier	o Pricing - Requires payment to utilise documentation for some APIs docs o Limitations - Free User tier does not support all desired functionalities o Set up - Lengthy set up process to gain access to account o API Key - Requires an API key for authentication

Fig 1: API Selection Process

Learning Topic Ideation and Selection

Throughout the ideation phase, our group considered various learning topics to address through our app. The 3 most popular learning topics we brainstormed included science, language and sports. This is evident through the table below*(figure 2)*:

After outlining the positives and negatives of each topic, as a team, we decided to come to the conclusion of selecting language as our chosen learning as we believed that entailed the greatest benefits, and will be the least complex to implement.

Learning Topic	Advantages	Drawbacks	APIs	Main Competitors
Science	○ Include features which allow users to stay up-to-date on latest scientific discoveries ○ Assist in simplifying complex scientific concepts ○ Engage users through quizzes, videos, online experiments ○ Target a specific demographic e.g. high school students ○ APIs	○ Require thorough knowledge of complex scientific concepts ○ Requires heavy content including significant text and images ○ Time consuming to ensure the accuracy of certain information ○ Significant amount of science learning apps in the market	○ NASA API ○ PubMed API	○ Khan Academy ○ NASA App ○ Science Lab
Language	○ Incorporate gamification elements easily such as leader boards, streaks for daily lessons, course tracking and challenges ○ Target a specific language and demographic – e.g. Spanish app for tourists travelling to Spain ○ Engage users through pronunciation practice, vocabulary quizzes and interactive videos	○ Learning app market is highly competitive with a compound annual growth rate of 28.1% from 2022-2027 ○ Require thorough understanding of grammar, syntax, pronunciation and cultural nuances	○ Google Translate API ○ Text-to-Speech (TTS) APIs	○ Dualingo ○ Babbel ○ Memrise
Fitness	○ Offer exercises to assist users achieve various fitness goals ○ Include features which monitor progress and record fitness plan ○ Engage users through goal setting, challenges and sharing achievements on the app	○ Different exercises for different body types, goals, diets which can add complexity to the app ○ Significant fitness tracking apps in the market ○ Requires various sensors and advanced technology to measure information such as heart rate	○ Google Fit API ○ Fitbit API	○ Strava ○ MyFitnessPal ○ Fitbod

Fig 2: Topic Selection Process

Desired Application Features

In order to ensure that the language app was presented in a meaningful way, we aimed to include the following features and formats:

Features	Details
Structured Learning Lessons	• Easy to difficult levels • Language, vocabulary, grammar, pronunciation • Topics e.g. greetings, animals, professions
Gamification elements	• Streaks • Daily challenges • Course tracking
Testing	• Quizzes • Written responses
Multimedia Content	• Videos • Images • Audio recordings
Notes	• Note taking features • Links to additional materials

Fig 3: Desired App features

Strategies to Distribute, Monetise and Grow App

To **distribute** the app, Aprender must consider **App store optimisation:** Present Aprender to popular app stores such as the Google Play Store and F-Droid with keywords and visuals to ensure greater customer reach. It is important to conduct research on keywords used by users to search for similar language learning apps, as well as identifying the most engaging icons that are memorable to customers. This strategy will allow for greater app visibility and lead to increased organic downloads of the app.

It is vital to **monetise** the app in order to ensure revenue and sustain growth. Certain monetisation that can be utilised by Aprender includes

- **In-app advertising**: Display advertisements within the app utilising a cost-per-click model whereby the number of times a user clicks on the app, a certain amount of revenue is generated. Utilising native advertising, will be the most effective for Apprender users as it will be in line with the app's user experience and be less disruptive to users.
- **Subscription model**:Offer a premium subscription service including exclusive content such as virtual pen-pals, ad-free content, additional study resources that are accessed by customers for a recurring fee.
- **Freemium model:** Provide core learning content such as Spanish vocabulary, sentence structure, grammar for free to attract users and restrict access to premium content. In this way, customers receive a small glimpse into the potentials of the app and have the option to pay extra for additional content.

In order to **grow** the app, it is vital to utilise content marketing to ensure the app reaches target demographic; in this case tourists travelling to Spain or individuals wishing to study Spanish. This includes creating infographics, blog posts or videos to inform users of the app's various features and functionalities, and sharing them on social media platforms to increase engagement and build a community. Additionally, leveraging positive user testimonials and reviews to display on the app store will influence users to download the app,and improve credibility. This is essential in increasing the app's development and growth. Furthermore, it is vital to utilise mobile marketing strategies particularly push notifications to send personalised notifications to users to ensure they engage in the content to drive app usage and promote new features.

Requirement 2 - UI Design Prototyping

Prototyping and Design Framework

Our group employed a divergent thought process by conducting rapid prototyping when first considering the desired functionalities of our app. Through active collaboration on Canva, we were able to discuss functionalities such as a quiz, profile page and notes page that would be appropriate in our English to Spanish app - Aprender. From there, we produced a more detailed UI prototype which contained feasible implementations of the app, and screens to include. This secondary

prototype provided examples of apps we liked and how we would implement similar features in ours.

User Navigation Flow

A simplified flow diagram *(figure 4)* was maintained to establish connections between pages in the app, highlighting how a student is able to navigate through functions and utilise Aprender. Firstly, the user begins their experience on Aprender through the Login Screen where they are prompted to enter their username as password, followed by clicking the login button. Alternatively, the student may login or register using their gmail account (personal or school). After which, they are directed to the home screen, with a personalised greeting and navigation bar directing them to four pages. The first of which is a courses screen where the student is able to view the course material split into 5 categories, and click into whichever course they wish to learn. From the navigation bar, they can access the quiz screen to test their knowledge and see their summary result at the end. The student can also make notes and add notes to their personal virtual notebook, as well as visit the quick translations page. Additionally, the student is able to logout with an easily accessible logout button within the home screen.

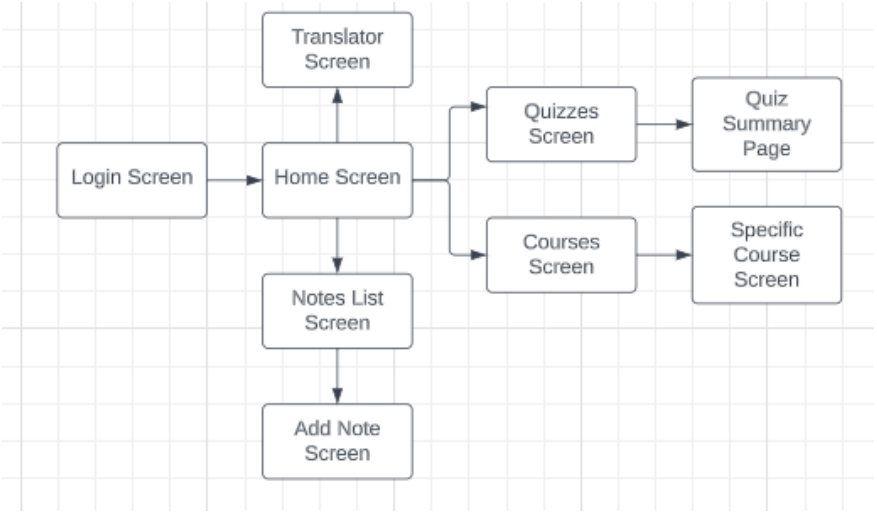


Fig 4: User Navigation Flow

App Feature Inspirations - Uber and Khan Academy

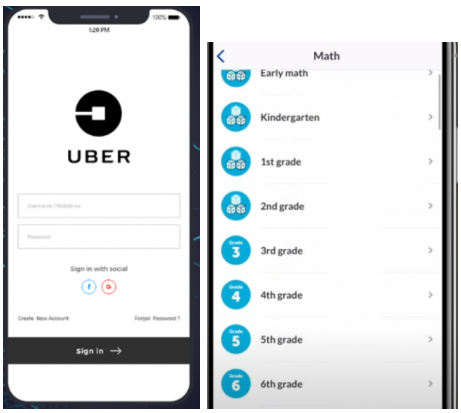


Fig 5: App Inspirations

The simple yet functional design of the Uber Login and Registration Page *(Figure 5)* provided our app with inspiration on our approach to the Aprender login and registration Page. Minimal colour abided by **Nielsen's Heuristic** guidelines of **consistency and standards** as a simple black and white theme was used across the whole page, for buttons and text as well as the logo. The screen also followed a simple and followable structure, guiding users to login or create an account if they do not have a login.

Khan Academy*(Figure 5)* provided inspiration for addressing the course screen within Aprender wherein the user is able to select the course they wish to learn about from a list of courses with a Title, subtitle and a small description on the course. As highlighted by the image above, Khan Academy presented the available courses in an ebay to read format, wherein the user can scroll down the list to their desired learning course.

1st Prototype UI design

Fig 6: 1st Low Fidelity Mockup

Labelled above*(figure 6)* is the initial prototype that came out of a rapid prototyping approach wherein the group collaborated to produce a basic framework for screens within our App. Although this was a low fidelity mockup, the prototype contained consistent user design and colour - with the same shape and colour for buttons. The prototype contains the following pages:

- Login page
- User profile page with course content
- Specific learning content page - with information on the language as well as possible links to other learning resources. E.g youtube videos. Also contains a button to the quiz page to get tested. First person used with “test me” recommended in some situations by Android material design.
- Quiz Page with question and user selected correct answer. The user is also able to check answer with a “Check Answers button”
- Learning Journey Summary page with progress of courses completed and return to home button.

2nd Prototype UI design

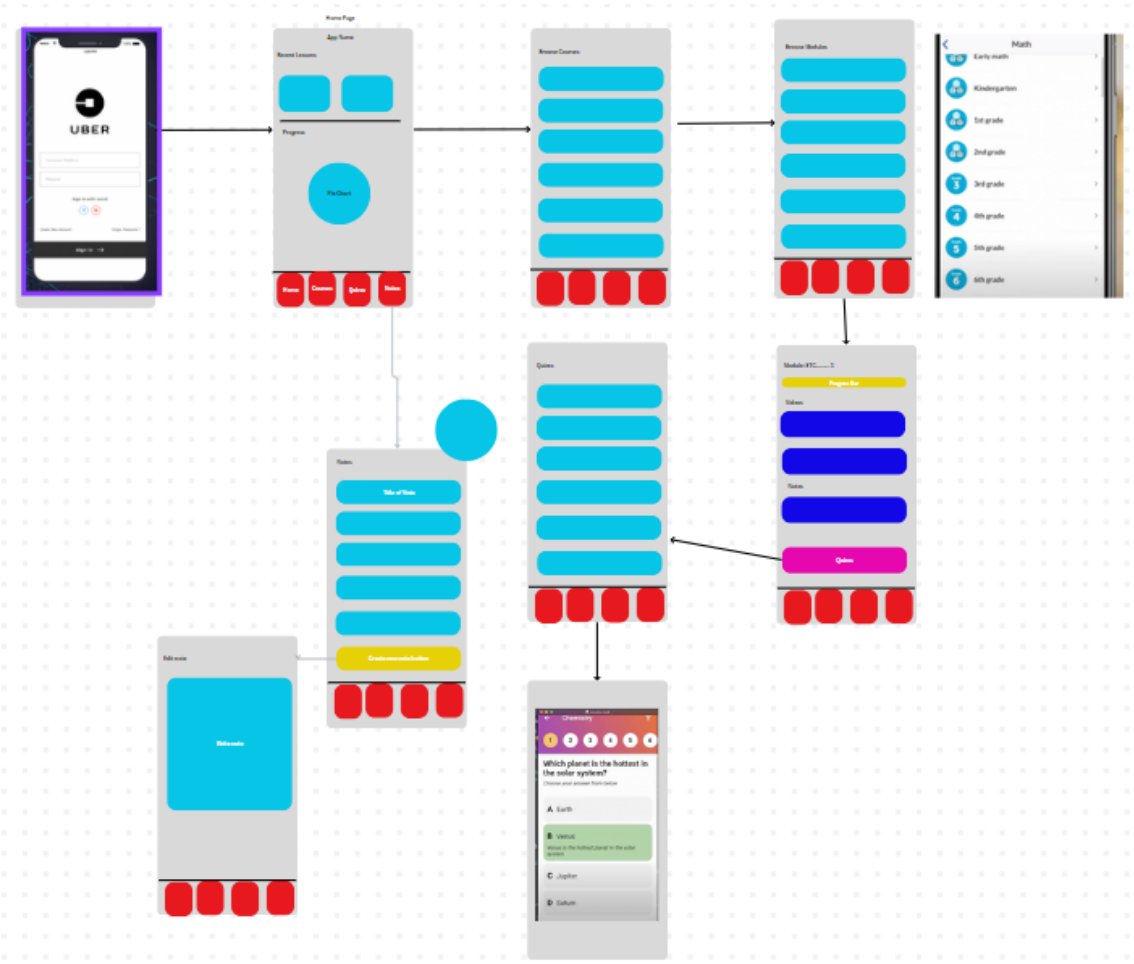


Fig 7: 2nd Mockup

A higher fidelity model*(figure 7)* was later developed highlighting user flows and navigation bars at the bottom. Utilising Canva, this prototype considered examples of applications which had ideal screens such as Uber or Khan Academy for the login and course list page. Additional screens such as the Notes list and note taking screen were added, as well as the quiz page.

Requirement 3 - App Development

Aprender Prototype

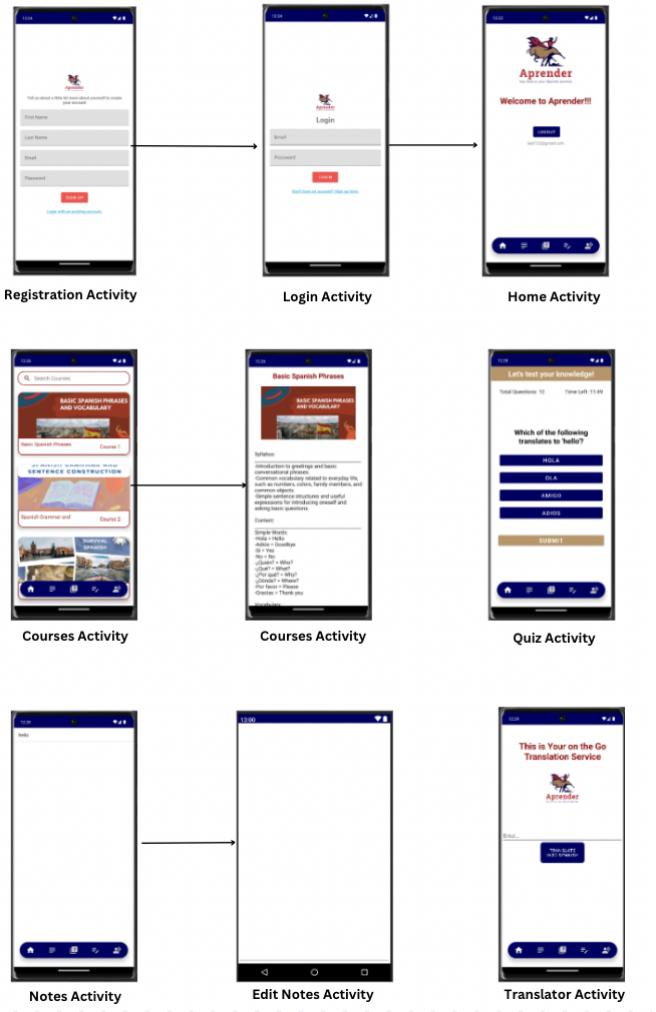


Fig 8: Final functional UI design

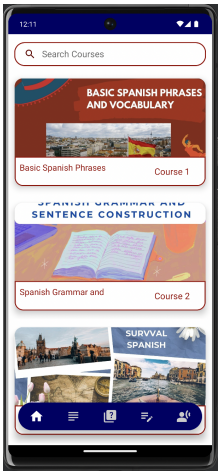
Aprender Functionalities

The functionalities contained within Aprender*(figure 8) are*:

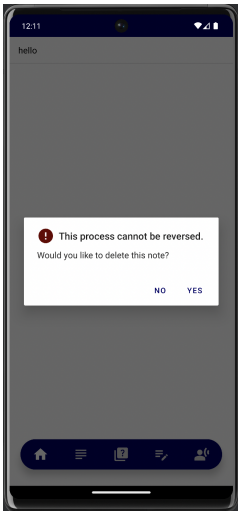
1. Login Page coupled with Firebase Integration allowing students to sign up with existing Google accounts. This may be authenticated as a school or personal account.
2. A personalised home screen highlighting the students completion of course material so far
3. Navigation bar at the bottom of each screen allows for ease of use. This implements the 'match between system and real world' within Nielsen's Heuristics (*Experience*) as navigation icons directly represent proposed functionalities. E.g home icon, writing for course content, notebook for note taking, questions for quiz screen and speaking for translations.

4. Course Content contained within a scrollable screen, wherein the student is able to browse for course their desire and view course material
5. Quiz page wherein the student is able to test their knowledge of the prior course content and answer a set of multiple choice questions with correct answers. Quiz summary displayed at the end, ensuring the student understands where they can improve on their knowledge of the language and where further study is needed.
6. Note display and note taking screen allowing for students to enrich their students in a particular topic of spanish language. The student is able to view each note's Title and click into it to view or add another note.
7. Translator Functionality wherein a student is able to get real time translation services when in need of a quick translation.

Influence of Android Material Design



Our development team aspired to abide by the android material design as it has a comprehensive guide for interactional, visual, and motion design throughout all platforms. Throughout this project, we focused on incorporating four essential features: ‘Elevation Shadows & Cards’, ‘Animations’, ‘Material Themes & Widgets’, and ‘Drawables’. To promote the use of standard user interface widgets, we ensured several floating buttons and a floating action bar was included. This is shown through numerous navigation and search features in all activities. This is also accomplished through in the implementation of styles and themes. Elevation shadows and cards were primarily used in the ‘CoursesActivity’, ‘CoursesDetailActivity’, and ‘NotesDetailActivity’ to display similar data in stylized containers as this provides a consistent interface for the user while provided the development team with ease. The use of animations were primarily utilised in the intent functions between activities (Home, Courses, Quiz, Notes, and Translator). A sliding animation was used to create an ergonomic and seamless experience for the user. Drawables were implemented throughout the project in numerous ways through vector, image, , drawable tinting, colour extracting, and resource files. This permitted the development team to design the interface to specific intricacies. For example, ‘search_bkg’ was used to personalise the design of the search bar within the ‘CourseActivity’.



The Nielson’s Heuristics were also abided, by following the principles. Users are constantly informed of the processes done by the application. For example, when deleting a note, the user is warned that the process cannot be reversed. The design of the system is intended to match the real world requirements shown through the simplacy of the terms, concepts, icons, and images. As shown by the warning message in the ‘NotesActivity’, the user has complete freedom and control. We utilised Jakob’s Law to ensure both internal and external consistency and standards as there is minimal cognitive overload. There are placements within the code to maintain error prevention. All elements, actions, and options are visible and retrievable to limit recall and maximise recognition. This is done through our

colour theme. We've implemented an aesthetic and minimalist design as the elements don't distract the user.

Changes to UI Expectations

Rigorous designing and Prototyping within android studio highlighted limitations within our App development initial prototypes. As such, some functionalities within the mockups were modified to allow for efficient coding practice and maintenance. An agile design thinking and prototyping framework was instead used to build the application as such constituting the following changes to our initial design:

- The removal of difficulty levels within each course
- Combining quizzes covering multiple courses into one encompassing quiz to test students' subject knowledge on Spanish learning.
- The focus on multiple choice questions only in the quizzes to avoid answers abstract in nature. Initially written responses were considered as a desired functionality however, such variation in answers would be difficult to determine objective correctness.
- Inclusion of images to browse courses (not only Title) ensuring an easier user experience for Students to understand the nature of the content.

Application Development Process

Intents were explicitly used throughout the application building process of Aprender. In order to pass data from one activity to another, explicit intents were called upon to initiate the next screen and utilise data from the previous screen. The use of intents are present in every activity of Aprender, between the Login Page to the Home Page, the home page to the course page as well as note page to add note page. The use of intents allowed for seamless transitions between one activity to another as messaging objects were called upon to perform transition to the next activity. Button objects wherein users click to perform a function utilised intents to move from page page to another.

Adapters are an integral part of constructing a functional application that allows users to move from screens and have their data saved. Adapters were thoroughly used within the construction of Aprender as arraylists were necessary to display a list of courses, notes and questions in quizzes. The use of adapters ensured content that required to be displayed from arraylists was able to be displayed in the UI view of the application in an easily viewed format. For example, adapters from the arraylist of courses, as displayed above are able to be displayed in the recyclerview of courses within the course page as the adapterview converts data stored into the array into an adaptable class translated into the activity UI.

Aprender utilised a **Firebase Integration** within the Login and Registration page of the application to ensure authentication of users logging into their profile. Firebase integration seamlessly ensured users were able to login with the simplicity of only requiring a Google account to create an Apprender profile. Ensuring simple and manageable logging into applications allows users to have

a hassle free user experience wherein they are able to access Aprender language learning services without the hassle of creating a new profile if they have an existing account. Our chosen form of authentication utilising Firebase authentication was through email address. A personalised UI experience is able to be created through Firebase Integration as user information is able to be returned to the user through callbacks. Such can be seen through the Aprender home screen, labelling the users name, greeting them in the application.

The use of **API queries** allowed Aprender to perform its translation capabilities and perform the main intended purpose of the app. By translating between English and Spanish, this API is able to allow users to understand the language through conversion into the known language of English. The user is able to input text of either language and have it translated by the api which is developed through its machine learning properties having access to a wide range of translations. Google's MLKit API allows Aprender to access existing translations and applications built by Google to feed into the backend of the program and support out translations.

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