**Key links in the research proposal story line**

This excerpt illustrates the kind and order of information provided in the introductory section of a research proposal, and in the introductory parts of the literature review and research design within a research proposal. The commentary in the right column of the table identifies the type of content and its features.

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| **Mock research proposal, abridged from Carerra, C. C., J. L. Saorín & S. H. Medler. 2018. ‘Pokémon GO and Improvement in Spatial Orientation Skills’, *Journal of Geography*, 0: 1–9.** | **Commentary on text** |
| **Title: ‘Pokémon GO and improvement in spatial orientation skills’**  **Introduction**  Map reading and wayfinding (or pedestrian navigation in the real world) are activities related to the skill of spatial orientation (Gonzato and Godino 2011; Irmischer and Clarke 2018). In geography and related disciplines such as engineering, architecture, geoscience, urban planning, and geomatics, geospatial information and spatial orientation skills are needed to work efficiently (Kastens and Ishikawa 2006). Professional bodies in geography education at the university level (Chueca et al. 2004; Ministerio de Ciencia e Innovacion 2009, 2013) and in primary and secondary education increasingly demand greater development of spatial orientation skills and emphasize the need for research on the teaching and learning of spatial orientation (National Council of Teachers of Mathematics 2000; Presmeg 2006; Battistam 2007).  In September 2016, at the beginning of the 2016–2017 academic year, researchers in the spatial skills development group gave a spatial orientation test to second year engineering students in the subject of cartography. The evaluation takes place at the beginning of each academic year to establish a base point for students’ spatial orientation ability. The 2016 results were better than in previous years. What had happened? Given that Pokemon GO had been launched in Spain two months earlier, the members of the research group decided to investigate its possible influence on students’ results.  Pokemon GO requires the use of two activities related to spatial orientation: map reading and navigation (moving from a start location to a real destination) (Montello 2005). While navigating, Pokemon GO players need to be aware of their location, and, in order to avoid getting lost, must continually orient themselves while moving toward their destination (Farret al. 2012). While literature on the educational value of computer games suggests they play an important role in spatial perception, little research has been done on their role in developing spatial orientation skills.  This proposal investigates the impact of Pokemon GO on the spatial orientation test results of 50 second-year engineering university students studying cartography. In order to identify other activities that may influence spatial orientation, participants also completed a survey asking them how often they used geoportals, navigators, or if they had participated in orientation activities such as orientation races. | Introduces the importance of the focus and the general context (academic disciplines and teaching of spatial orientation)  Note that authors and studies are backgrounded, and references placed at the end of ideas to give assertive tone.  Introduces specific context of the research, and an unresolved question in the context.  Introduces ‘what is known’, and ‘what remains unknown’.  Provides introduction to research design linked to the research aim.  Note that the research focus, ‘spatial orientation’, is repeated in the title to clearly indicate the research purpose. |
| **Literature review**  Computer games **have proven to be** a powerful tool for the development of spatial skills (Do and Lee 2009; David 2012). **Currently much of the literature supports** computer games’ ability to improve spatial skills like spatial perception, spatial visualization, and mental rotation, but **the research on** improving spatial orientation with computer games is more limited. **For example, Lin, Chen, and Lou (2014)** **carried out an experiment with** a commercial treasure hunt game, in which the player used a map to determine the location of the hidden treasures. **In that research** the impact of a game-map-reading activity on the spatial orientation of the players **was analyzed**, but navigation task activities (wayfinding) were not performed.    **It has been found that** external references in the environment (landmarks) play a prominent role in wayfinding and localization processes (Raubal and Winter 2002), and provide a confirmation of the route during pedestrian navigation (Sorrows and Hirtle 1999). **Shelton and Gabrieli (2002, 2004) found that**, in survey learning, one’s orientation in an environment can be perceived through north-up alignment, or alignment with observable landmarks in the environment, such as landforms or buildings. **As Kiefer, Giannopoulos, and Raubal (2014) observe**, wayfinding, self-location and spatial orientation are crucial tasks in map reading. In survey learning or mapreading tasks, the perception of orientation is the north of a map or alignments with existing elements.  **Studies also show that** Pokemon GO integrates spatial knowledge acquisition **(**Tartre, 1990a; Golledge, Dougherty, and Bell, 1993; Liao et al. 2017; and Irmischer and Clarke 2018). **These studies observe that**, while playing Pokemon GO, real-world streets and buildings are represented on a map, which indicates where the player is located. There is a compass to orient the map in the north direction, but the usual strategy is to position the map in the same direction in which the user walks. At the same time, in wayfinding, navigating, or route-based learning tasks, one’s orientation can be perceived through the objects in the environment while in movement. This happens in the search of Pokemons, which are also associated with a geographical location. They are invisible until the player is at a certain distance from them, which is when they become visible and can be captured. Thus, the player needs to navigate in the environment, and go orienting themselves with external references from the real world that appear on the map while moving. It is therefore appropriate to ask whether Pokemon GO, which draws on map reading and wayfinding tasks, promotes the development of spatial orientation. | **Bolded text indicates** **generic language of the type typcially found in research literature reviews**. The bolded language indicates to the reader that the purpose of the text is to summarise what has been done to date on the topic. (This type of language is less common in framing problems in the introduction, and in explaining the research design).  The second sentence provides a synthesis of the literature. It also introduces the research ‘gap’ using a constrastive statement—we know this (computer games improve spatial perception, visualisation, mental rotation), but less is known about (the research focus, whether games improve spatial orientation).  Note how the subject of the review ‘narrows’—the first paragraph refers to literature about computer games and spatial orientation, then to literature about external landmarks in spatial orientation, then to literature specifically about Pokemon GO and spatial orientation, and finally to a statement of the precise focus of the research, in the form of a research question.  Literature is used to justify key assumptions underpinning the research question (external references in the environment are important in spatial orientation, and Pokemon GO incorporates external references in the environment). Closes with statement of the research question. |
| **Method**  **In order to understand the impact of Pokemon GO on spatial orientation**, **the research will** compare the test results of engineering students of the subject of cartography of La Laguna University from one year to the next. The test used to measure spatial orientation is the Perspective-Taking Spatial Orientation Test which is performed each academic year at the beginning of the course. This spatial-orientation skill measurement tool has also been used in previous research papers (Hegarty and Waller 2004; Kozhevnikov and Hegarty 2001) and was found provide a valid measure of spatial orientation skill.  Noticing the difference in spatial-orientation ability in 2016 compared to 2017, **we hypothesized that** the recent appearance of Pokemon GO might be responsible for this change. **Therefore, we used the** available collected data to assess the possible impact of Pokemon GO on students’ spatial orientation skill. The working hypothesis to analyze the effect of Pokemon GO on spatial orientation skill was that students who played with Pokemon GO would exhibit higher spatial orientation skill than those who did not play.  **In order to determine** how many of the participants play Pokemon GO, **and to quantify** dedication to the game, students will be asked to indicate in a survey whether they play Pokemon GO, and those who play will be asked the number of kilometres they traveled (the Pokemon GO app measures the number of kilometers traveled while playing) prior to taking the test. **This measure will enable us to determine whether** the duration of time spent on the game exceeds that of other workshops related to the development of spatial orientation. **Consequently, it will be possible to determine whether** time spent playing Pokemon GO could have factored into the improvement of the spatial orientation skill. | **Bolded text highlights** how the aim is restated in the introduction to the research design, enabling the reader to see a direct link between the aim and method.  References are used in this section to justify the choices made in the research design, in this case the decision to use a survey test.  States the research hypothesis.  **Bolded text in this paragraph** is used to indicate language used to explain why specific aspects of the research design were chosen. |