Department of Geography

Immersive Tools for Field-Based Geoscience: Augmented and Virtual Reality Tours to Coastal Forests and Alpine Ecosystems

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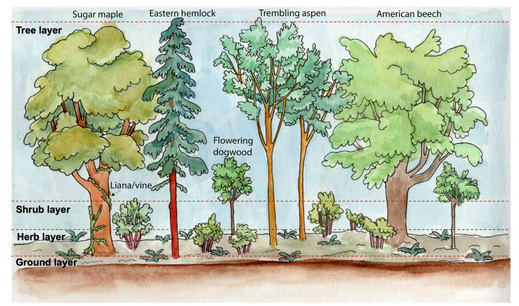
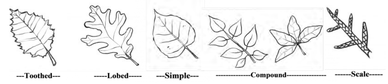


Introduction



Geoscience education is rooted in experiential, field-based learning. However, short class times, large student numbers, variable TA expertise and distance to field sites hinder outdoor education, especially in large courses. Digital pedagogies are poised to address such challenges (Box 1, below).

Box 1. *Definition and value of the digital tours employed here.*

Augmented Reality (AR) Tours: mobile app-assisted trips **to sites that are actually visited**; enhances a conventional field trip

Virtual Reality (VR) Tours: interactive 360º models that **replace a trip to sites infeasible to visit**; provide a more immersive spatial experience than 2D imagery, text allow

We created several tours to examine Coastal forest and Alpine ecosystems in BC and beyond (Table 1). We highlight two**:**

1) A self-guided, mobile-app assisted Augmented Reality (AR) tour of the ecology of Pacific Spirit Park (49˚ 16’11” N, 123˚ 14’20” W). This is modelled on an existing TA-led field trip in GEOS 102, *Our Changing Environment: Climate and Ecosystems*;

2) a Virtual Reality (VR) tour to explore species, ecosystems and landforms of a portion of S. Chilcotin Mountains Provincial Park, BC (50˚ 58’11” N, 122˚ 48’54” W) (Fig. 3).

Highlighting basic ecological concepts and human impacts, these tools offer immersive, visually rich education about BC’s changing ecosystems suitable for use or emulation across biogeosciences curricula.

Table 1. *List of AR and VR tours developed by the team*

VR Field Tours	AR Field Tours
Coastal Forests	
1 Pacific Spirit Forest	1 Pacific Spirit Forest
2 Dakota Bowl, Mt Elphinstone	
Alpine, Montane	**Eastern Forests/Savanna**
3 South Chilcotins Alpine	2 High Park Oak Savanna
4 Elfin Lakes Garibaldi	
5 Manning Park Alpine	

Example 1: Pacific Spirit AR

The AR tour guides along a specified forest route using a mobile app. Audio narrations with site specific info are geolocationally triggered. Focal sites includes an early successional stand (cleared ~65 ya) and a later successional Douglas fir forest (logged ~100 ya). A companion website hosts additional visual media (videos, photos, text) and a dichotomous species identification key. To engage with colonial and traditional legacies, students are asked to reflect upon settler-colonist management actions in the park, and contrast them with those of the xʷməθkʷəy̓əm peoples (Figs. 1 & 2).

Impact: A focus group study comparing the AR to a traditional TA-led tour found strong benefits, cognitive, affective, and other (e.g., flexibility; Figs. 3 & 4). The AR further provided the storyboard for a VR version that proved essential in the pandemic, is published for wider use (Hewitt 2021a), & is part of a SoTL Seed study.

Fig. 1. *Screenshots of the mobile-app interface with welcome screen, map, waypoint signal, and media archive (Hewitt et al. 2022)*

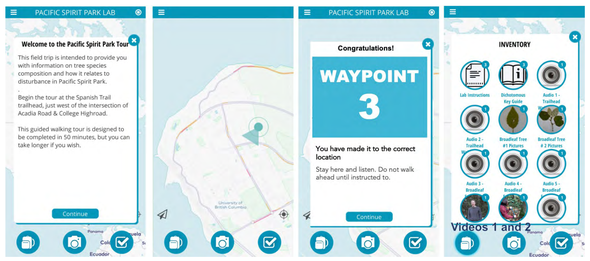


Fig. 2. *Sample media from companion website to contrast extractive settler forest practices with those of the xʷməθkʷəy̓əm.*

Clearing the Point Grey campus, 1914; *Source: Thomson, S. doi: http://dx.doi.org/10.14288/1.0018818*

Douglas fir being harvested in Oregon, 1905. *Source: I.F. Ford, Public Domain.*

Example 2: Alpine VR

The alpine VR takes students through 9 stops from montane forest into the alpine zone. Users explore the landscape in 360˚ photos where embedded “hotspots” provide added content (drone footage, narrative info.); a GoogleEarth Web tour provides geographic context (Figs. 5&6). **Impact**: The associated lab assessment (GEOS 309: *Biogeography and Global Change*) has been a student favourite, both in online sections (2020-1 pandemic), and in-person (2021-2) sections (Hewitt 2021b).

Fig. 3. *Responses to 5 point Likert scale questions. Bars indicate frequencies (details in Hewitt et al. 2022).*

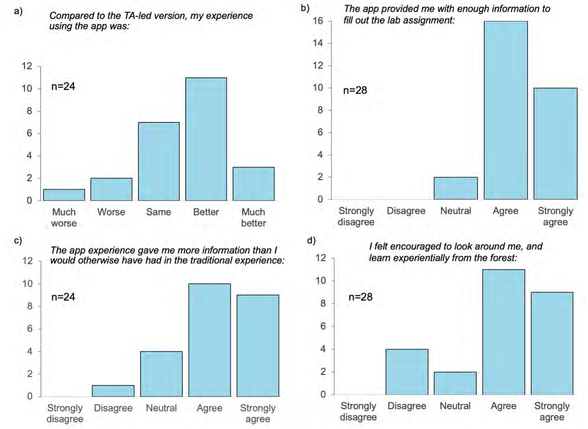


Fig. 4. *Drawbacks and benefits of the AR tour across thematic categories based on comments from student survey data (ibid.).*

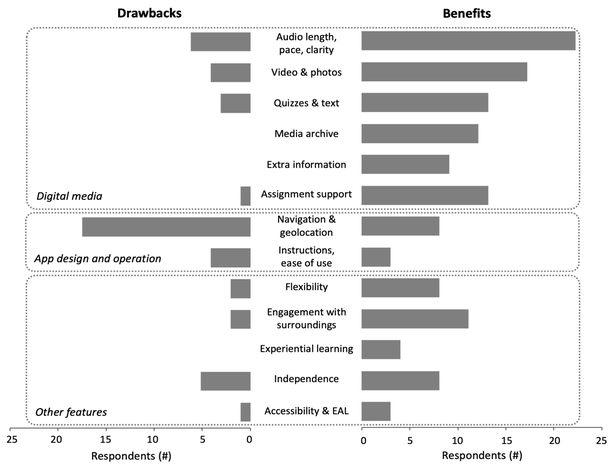
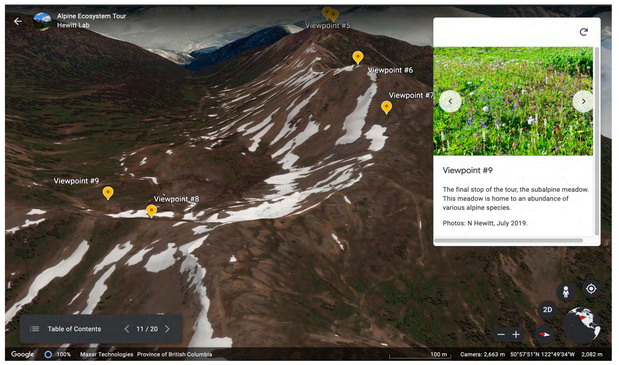


Fig. 5. *Select media, Alpine VR tour: **A**: 360 º photo for tour stop with embedded hotspots for videos (inset), information panels and arrows for navigation; B Screenshot, accompanying GoogleEarth Web tour.*



Conclusions

These tools and assessments enhance flexibility of in-field tours (via AR); and enable immersive learning when field visits are prevented (via VR). Even for in-person teaching, VR tours may augment experiential components to increase accessibility (for persons, or to remote sites). The tours are transferable across disciplines, and are available as open (CC) online, adaptable (SA) resources (e.g., GEOG Virtual Spatial Experiences)

References:

Hewitt, N. 2021a. Lab 12: Coastal Forests Virtual Field Trip. In MacKinnon et al. Lab. Manual, Intro to Physical Geography, 2nd Ed.

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Hewitt, N., S. Wood and B. Wilson. 2022. Ecosystem education with Augmented Reality: A flexible tool for in-field learning. *Prof Geog*.

Botanical drawings by Sara Hewitt Wood.

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