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Teaching and Learning Conference ENLIGHT 2024

University of Bordeaux Award Nominee: ITAP project

1. COVER SHEET (1 page)

ITAP project: Enhancing the learning of evolutionary anthropology skills by combining student-active teaching with physical and virtual immersion in archeological fieldwork, laboratory practice and dissemination

Training students in evolutionary anthropology requires that we provide them with a thorough knowledge of biological and cultural heritage sites and collections that are frequently inaccessible. Indeed, most archeological sites, fossils, and remains can be visited or handled only rarely and only by specialists with extensive experience. Thanks to the development of 3D imaging techniques, this fragile heritage is now more widely accessible. However, solely relying on virtual learning can negatively impact student engagement and exchanges with instructors, making it an undesirable standalone teaching method. To encourage student engagement and enhance their acquisition of new professional and interdisciplinary skills, we therefore offer Master's students in archeological sciences at the University of Bordeaux real-life situations in archeological fieldwork (inclusion in scientific teams and participation in excavations), laboratory studies (participation in teams and workshops at the PACEA laboratory), and dissemination of research results (organizing symposia). To enable students to work with resources and train in otherwise inaccessible methods, we complement this physical immersion with virtual access to research activities (immersive videos in the field and in the laboratory), and to archeological, experimental or reference materials (microtomographic and photogrammetric 3D models, surface scans, 2D X-rays, photographs).

Profile of all educators involved:

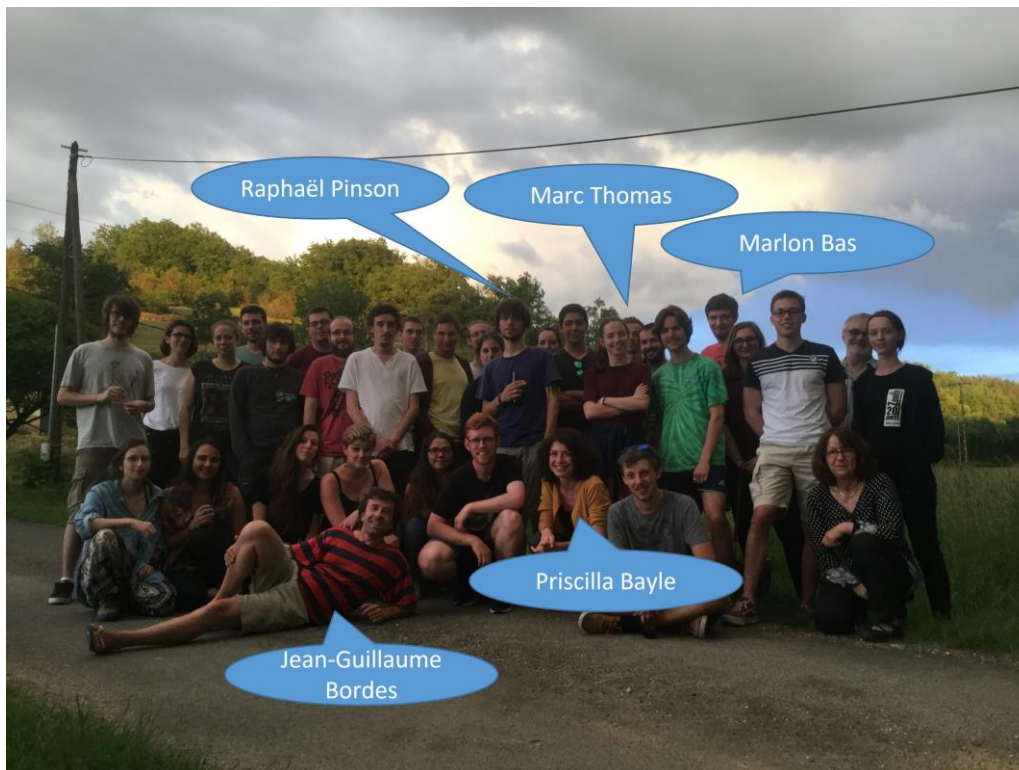
The ITAP project includes all the members of the teaching team from the Biological Anthropology (AB), Archeoethnology (At) and Prehistory, Geoarcheology, Archeozoology (PGA) study tracks within the Master's in Archeology and Sciences for Archeology (ASA), who are all members of PACEA laboratory, as well as other members of PACEA, staff hired specifically for the ITAP project and members of Mission d'Appui à la Pédagogie et à l'Innovation (MAPI) at the University of Bordeaux.

Project leader: Priscilla Bayle – Associate professor in Paleoanthropology at the University of Bordeaux, Deputy director of PACEA.

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Co-leader: Jean-Guillaume Bordes – Associate professor in Prehistory at the University of Bordeaux

Project members: Serena Asti (Fieldwork assistant), Dominique Armand (Collection management engineer), Marlon Bas (Lab assistant), Maryelle Bessou (Collection management engineer), David Cochard (Associate Professor in zooarcheology, responsible for the ASA Master), Christine Couture (Professor in paleoanthropology), Marie-France Deguilloux (Assistant professor in paleogenetics, responsible for the AB study track), Catherine Ferrier (Assistant professor in geoarcheology, responsible for the PGA study track), Thomas Girault (Lab assistant), Cathy Haget (Lab and fieldwork assistant), Malo Hesry (Fieldwork assistant), Jacques Jaubert (Professor in prehistory), Christopher Knüsel (Professor in bioarcheology), Ronan Ledevin (3D imaging engineer), Stéphanie Martins (Pedagogic engineer), Caroline Masset (Lab assistant), Miriam Mesa-Saborido (Fieldwork assistant), Christophe Michenaud (Computer sciences engineer), Raphaël Pinson (Fieldwork assistant), Eric Pubert (Bioarcheology assistant engineer), Stéphane Rottier (Assistant professor in funerary anthropology, responsible for the At study track), Anthony Sécher (Fieldwork assistant), Antoine Souron (Assistant professor in paleontology), Adrien Thibeault (Lab assistant), Marc Thomas (Fieldwork assistant), Nicolas Vanderesse (3D imaging engineer)



2. PORTFOLIO (2-4 pages)

Here, we present examples of experiments conducted in the ITAP project using both physical and virtual collections of archaeological, experimental and reference materials, as well as full student immersion in fieldwork, laboratory and broad public dissemination settings that help break down the barriers between higher education and the professional world.

At a time when practical, in-person learning activities are threatened in universities all over the world, we aim to strongly advocate for active and collaborative teaching and learning strategies, as well as to contribute to the global reflection on the appropriate use of virtual tools in higher education by combining them with real-life situations.

1. Enhancing problem-solving, critical thinking, decision-making, and collaboration by real-life immersion in fieldwork settings: the yearly off-campus field school

Located in a region renowned for its well-preserved and numerous prehistoric archaeological World Heritage-listed UNESCO sites, the Master's program in archeological sciences at the University of Bordeaux has a long tradition of immersive teaching, offering field schools on sites that have been studied for over a century to gain insights into biological and cultural evolutionary history. Our institutional network, which includes the Ministry of Culture, the Musée National de Préhistoire (MNP, Les Eyzies), the Institut national de recherches archéologiques préventives (Inrap), other public and private salvage archaeology organizations and the Pôle d'interprétation de la Préhistoire (PIP, Les Eyzies), provides a unique opportunity for students to engage with a diversified professional and socioeconomic environment, especially during field trips. The students complete a three-week fieldwork course in the first year of a two-year Master's program. This off-campus course is based on the excavation of archaeological sites. The aim is to train students in the ins and outs of fieldwork through a hands-on approach which involves project design (including legislative and regulatory constraints), excavation set-up, excavation methods and tools, data collection and analyses, and the design and writing of a final excavation report.

Depending on their specializations, students can choose between two field schools. One field school takes students to the excavation and associated fieldwork of a prehistoric site. Here, the research objectives are to reconstruct the biological and cultural evolution of past hominins based on the study of their biological identity and lifeways. Every year, students are divided into groups, with each group responsible for excavating a specific area of the site (generally a quarter of a square meter) and handling the associated post-excavation processing, as well as writing the excavation report for that part of the site. Students are invited to propose excavation strategies for the area they are entrusted with, and to discuss their ideas with the supervisory team. This experiential off-campus learning fosters exchange with instructors on observations made directly by the students in the field, giving them a better grasp of the related questions. By giving students the opportunity to excavate renowned archaeological sites, and to work with authentic archaeological material, the field school offers them a unique opportunity to make new discoveries, sometimes of major importance to our knowledge of human evolution. Giving them enough time to manage the entire process, to actively work as a team and to optimally interact with all the specialists involved in the fieldwork increases their engagement to reach common objectives, placing this course at the most student-active end of the off-campus experiential learning spectrum. The positive effects of this practice have been highlighted in recent years by the students' ability to generate new questions during fieldwork, reveal new findings, and contribute to excavation reports and further dissemination of results.

- > A video documenting the steps of the field school was created during the 2021 field school at the Pleistocene hunters-gatherer base camp of Le Piage (Fajoles, Lot, France): https://youtu.be/iKt3Kj6TEyQ?si=sUR_MkYLuYPtasdN.

2. Enhancing anticipatory thinking, personal and digital competencies by virtual immersion in field and laboratory work: the ITAP digital resources

Owing to their non-invasive nature and high potential for real-time exploration and quantification of structures, 3D imaging techniques are now widely used in evolutionary anthropology. In addition to its value in the virtual exploration of sites that are rarely or not at all accessible, 3D imaging can be used to allow students or volunteers to explore a site before they participate in its actual excavation. In 2018, we began to develop the “Virtual Sirogne” application which provides a dynamic introduction to this prehistoric cave (Rocamadour, Lot, France), where lithic artefacts and fossil remains, including about 90 Neandertal remains belonging to at least 10 individuals, were found during the excavations conducted by us since 2013.

- > See a drone flyover and a visit of the 3D model of the cave here: https://youtu.be/BYhtfV_5R44?si=5f-0bKPqejlA-or-.

The application includes photogrammetric models of the whole cave, its fill, objects, non-human animal fossils, as well as microtomographic-based images and 3D models of the Neandertal remains.

- > A demonstration of the “Virtual Sirogne” application can be found here: https://youtu.be/2FEpzQKcDx0?si=c7jFXQPkiftFp_uQ.

This 3D experience provides, in a unique way within higher education, real-time full access to human remains virtually presented in the 3D model of the site of their discovery, and also offers prior immersion in a real-life archaeological excavation. Thus, students and volunteers participate in the fieldwork only after acquiring in-depth knowledge of the context and challenges of the field research being conducted. In addition to those displayed in the “Virtual Sirogne” application, the fossilized and modern teeth and bones, as well as archaeological and reference lithic and bone artefacts, and personal ornaments studied by laboratory members have now been digitized in 2D and 3D at different resolutions as part of the ITAP project. Thus, the archives on the educational platform of the University of Bordeaux include 3D and 2D models specific to our field and laboratory research, intended for use as teaching resources associated with online exercises so as students can acquire these new essential professional skills.

- > The archive and resources are freely available for consultation by all on this web portal: <https://pedagogtec.u-bordeaux.fr/apps/itap/>.
- > A demonstration of the use of the archive can be found here: <https://youtu.be/qs5F8bYV2Ro?si=5hMOjlq2tFC4zFKC>.

The digital resources are used in practical courses by Master’s students to complement their work on physical materials. Furthermore, since access to the laboratory techniques is limited owing to space constraints in the laboratory, learning the laboratory skills necessary to extract bioarchaeological data was only possible late in student study programs, typically not before Master’s or PhD thesis research. To circumvent this issue, we decided, in ITAP, to propose immersive videos in our lab, as well as real-time 3D applications.

- > Videos, with subtitles in English and Russian, in PACEA technical areas can be found online on Canal U:
- 3D microscanner analyses for biological anthropology and archeology : <https://www.canal-u.tv/chaines/univ-bordeaux/analyses-3d-par-microscanner-pour-l-anthropologie-biologique-et-l-archeologie>
- Preparing thin slides to study dental microstructures: <https://www.canal-u.tv/chaines/univ-bordeaux/realisations-de-lames-minces-pour-l-etude-des-microstructures-dentaires>
- Confocal microscopy in archeology and paleontology: <https://www.canal-u.tv/chaines/univ-bordeaux/la-microscopie-confocale-en-archeologie-et-en-paleontologie>

- Reproducing objects by silicone impression and making resin replicas: <https://www.canal-u.tv/chaines/univ-bordeaux/reproduction-d-objets-par-prise-d-empreinte-en-silicone-et-tirage-de>

Our real-time 3D applications allow students to learn comparative osteology of mammals, including primates, or carry out dental histology using a microscope. The “Comparative anatomy” application enables students to compare the teeth and bones of over fifty species of mammals and test their knowledge. Using the “Virtual microscope” application, students can learn to adjust a microscope and study dental tissue microstructures, gaining insights into individual growth, stresses factors, and seasonal hunting patterns of prehistoric human groups.

- > Demonstrations of these applications can be found in PACEA YouTube channel: <https://youtu.be/ScIHrFoCsU8?si=Yc2Mylcw-APr2WSi> for “Comparative anatomy”, and <https://youtu.be/ZpPWydtdo2E?si=ZQynlQFBMZPc31BL> for “Virtual microscopy”.

3. Enhancing innovation capacity, creativity, collaboration, and communication skills by disseminating science: the yearly Master’s students symposium

In parallel with their virtual and on-site immersion in both the field and laboratory, Master’s students complete another student-active experiment which takes them to the final phases of the scientific process, in other words, disseminating results.

To this end, following an introduction on how current scientific research works (designing a project, building a team, seeking funding, dissemination, peer-reviewing process), they organize a poster symposium based on a major research topic in evolutionary anthropology. Students partake in both the symposium organizational and scientific committees, assuming all the roles involved in organizing a symposium, including an editorial committee, communications, internal organization, purchasing and finances, graphic design, and organization of the day itself.

They must actively work together and interact with departmental members during the half-day poster symposium held in the PACEA teaching laboratory. The entire course and the symposium are conducted in English to bring the students as close as possible to a real-life situation.

Before the symposium, each student interacts with a scientific referee in the laboratory to prepare an abstract based on relevant references, and a poster on the subject of their choice. They also experience the peer-review system by evaluating each other’s abstracts. The students are all highly motivated, as seen in the books of abstracts produced in previous years that follow professional standards, and by the success of the symposia, which reflects the atmosphere of the scientific exchanges between students and researchers. Moreover, the outcomes of this exercise are also extremely positive as the students frequently continue to work on their chosen topic in the context of a Master’s thesis, often under the supervision of their symposium referee.

In this immersive course, students can experiment their innovation capacity and creativity by proposing collaborative events. For example, one year, they invited researchers to a workshop on writing articles. Another year, they organized a mock scientific and recreational debate on the societal usefulness of archaeology.

They can also develop their sense of civic responsibility and understand how our disciplines can contribute to major societal issues. For example, the theme of the 2022 symposium was: “How can biological anthropology and prehistory contribute to major societal issues?” The goal was to offer students and PACEA members moments of sharing and forward-thinking on the contributions of our disciplines to major societal challenges. The students organized their symposium around the 17 Sustainable Development Goals of the United Nations. The high-quality and impact of their symposium on the scientific community offered them the opportunity to present their work in summer 2022 during the GALF (Groupe des

Anthropologues de Langue Française) conference in Bordeaux. To this occasion, they presented an oral communication in the session called "Teaching anthropology in the 21st Century"¹.

In conclusion, the ITAP project examples align with similar experiences and neurobiological research findings, strongly supporting active teaching and learning strategies and "think-pair-share" methods that capture student attention and help develop their skills and practices. Moreover, these experiences advocate for the use of virtual tools to enhance active teaching and learning strategies by immersing students in real-life professional situations. They exemplify the best aspects of incorporating virtual elements into evolutionary anthropology courses, enabling access to sites, fossils, and objects otherwise unavailable, and revealing data preserved on microscopic or nanoscopic scales on their surfaces. Additionally, theoretical fundamentals such as home-based self-learning, which are prerequisites for productive face-to-face classes, are instilled and reinforced. Using virtual experiences this way can help alleviate time constraints, freeing up time for face-to-face educational opportunities like fieldwork, practical sessions, mentoring, and seminars presenting state-of-the-art advances and future research directions. In other words, we believe that universities should not replace in-person learning with virtual courses but rather leverage digital opportunities to enhance traditional coursework and train students in addressing future societal challenges.

Finally, active teaching strategies that promote participant inclusion can be implemented not only in classroom, laboratory, and fieldwork settings but also in the conceptualization of learning strategies. Students were involved in each developmental step of the ITAP immersion program, playing an active role in continually improving educational practices for future generations.

Inherently interdisciplinary, evolutionary anthropological resources can serve as practical examples for instructors in various fields such as geology, biology, physics, imaging, ecology, and health sciences. The digital resources produced by ITAP are freely available for teaching and educational purposes and are already being utilized by students in dentistry and odontology at the University of Bordeaux. These resources can also be valuable for educators and researchers within the ENLIGHT community. For instance, they could be incorporated into courses on paleoanthropology, biological anthropology, primate evolution, and archaeology at the University of the Basque Country and Ghent University.

- > The ITAP project description and resources are available in the dedicated website: <https://pedagogtec.u-bordeaux.fr/apps/itap/>.
- > Furthermore, we outlined the philosophy and approach guiding us in the ITAP project in an article published in the Academic Practice section of the open-access journal *Ecology and Evolution*².

¹ Barrera J, Boisgontier J, Ernoul T, Fedani C, Fuchs J, Gérardin R, Mayor F, Michel A, Picard S, Scapolan C, Couture C, Bayle P. 2022. Le symposium 2022 des étudiants en master 1 Anthropologie biologique – Préhistoire à l'Université de Bordeaux : "Quels apports de l'anthropologie biologique et de la préhistoire aux grands défis de la société ?" XXXIV^{ème} colloque des Anthropologistes de Langue Française. Transmissions en anthropologie, Bordeaux, France, 30 juin-1er juillet 2022 (podium).

² Bayle P, Armand D, Bessou M, Cochard D, Couture C, Deguilloux M-F, Ferrier C, Haget C, Jaubert J, Knüsel C, Martins S, Pubert E, Rottier S, Souron A, Beauval C, Caillo A, Dutailly B, Girault T, Hesry M, Lacrampe-Cuyaubère F, Ledevin R, Masset C, Mesa-Saborido M, Mora P, Muth X, Pinson R, Thibeault A, Thomas M, Vanderesse N, Bordes J-G. 2022. Enhancing the learning of evolutionary anthropology skills by combining student-active teaching with actual and virtual immersion of Master's students in fieldwork, laboratory practice and dissemination. *Ecology and Evolution* 12: e8825. <https://doi.org/10.1002/ece3.8825>.

4. PHOTOS



BIOGRAPHIES OF PAST HUMANS AND THEIR MATERIAL CULTURES
 4th SYMPOSIUM - 2017/2020
 ORGANIZED BY M1 BIOGÉOSCIENCES - UFR

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