Erasmus+ ABC to VLE : beyond curriculum design Erasmus+ project 2018-2020

Sorbonne University case study 1 : Redesigning a Master's degree course at the Faculty of Sciences and Engineering

Summary

Institution: Sorbonne Université

Description: Re-design of a Master level course using ABCD method

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**Course title:** Positioning and satellites physics

Course details:

Master degree course on physics « Positioning and satellites physics ». It's an optional course that has been redesigned with new active learning activities. This course was on the curriculum the years before. The teaching team expressed the wish to review the design of the course with the aim of stimulating the participation of the students and encouraging the collaboration and exchange.

As an optional course at Master's level, 23 students took and attended the course. During the 2018-2019 academic year the course was proposed only in the face to face format. This course validates 3 ECTS for the students.

During this course, students had to use Moodle to check the course objectives each week, and to retrieve the pedagogical documents needed for working during and between the sessions.

Case Study
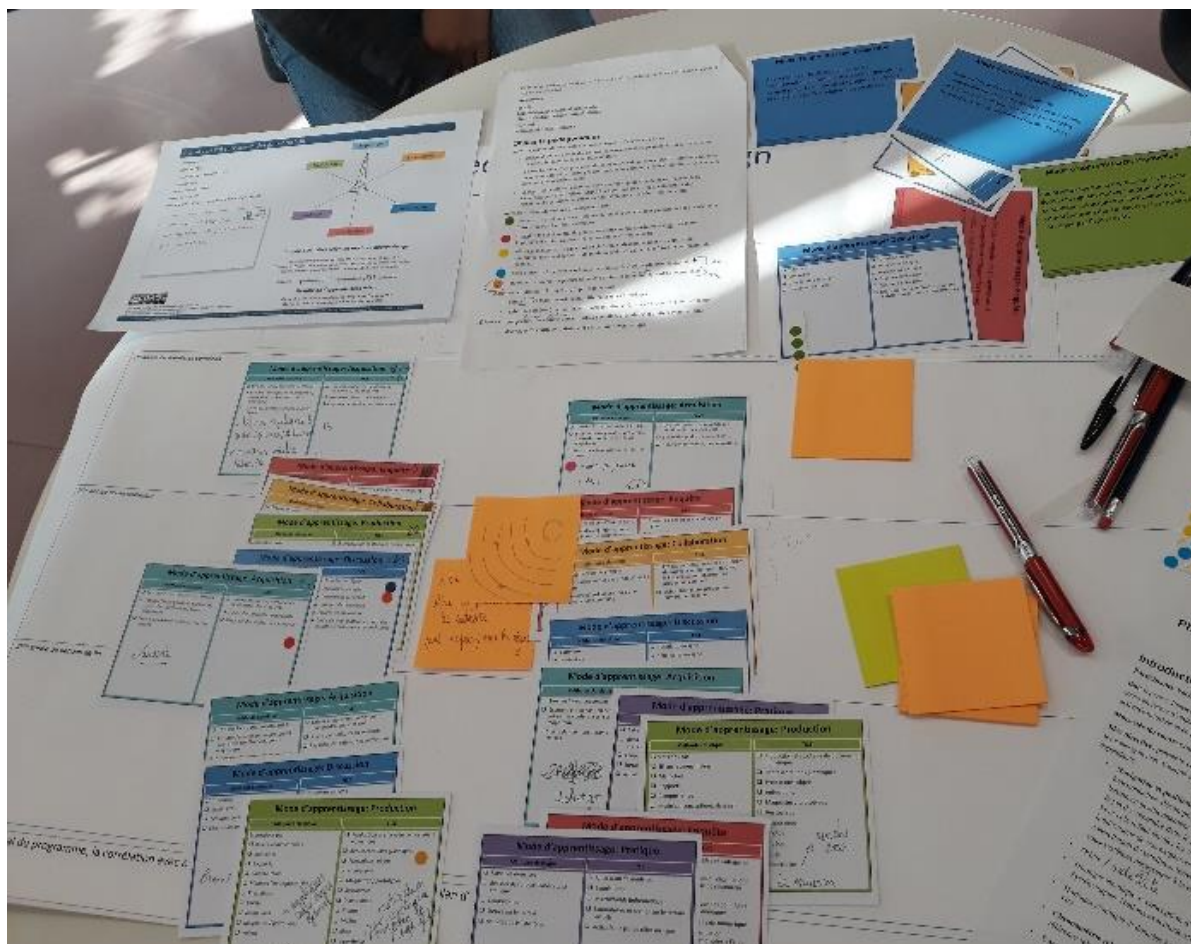
Here are some examples of the comments left by students in the evaluation that followed the course:

"Well adjusted to the content of the course and pleasant because it brings us closer to the type of reasoning expected in the jobs we want to do"

"The course was much more lively every week we knew that the course would be different from last week."

"Only course where the student-teacher interaction is really present, which allows us to easily engage in the course."

"This encourages reflection with the teacher and other students"

Context of change

The ABCD workshop is part of the general offer of our university for the academic development on pedagogy. Our university proposes a large offer of workshops and trainings for its academic staff, as the academic development is one of its major priorities. Blended learning is one of the top projects, and ABCD is one of the workshops helping designing or re-designing a course towards a blended format.

The teaching team involved in this study asked for the participation on the workshop.

ABC workshop plan

The ABCD workshop as proposed at Sorbonne University is an adaptable workshop that aims answering the specific needs of each teaching team in terms of course design. The workshop is facilitated by an expert, specialised in academic development and instructional design.

The groups or individuals work with the expert and continue their work after the end of the workshop. Depending the needs, the time length of the workshop is around 3 hours. A precise description of the materials used and the methodology of the workshop follows:

Intended learning objectives of the ABCD workshop
At the end of this workshop, the participants will be able to:
• Use the proposed tools for building the pedagogical sequences of a course / module / curriculum
• Reach the intended learning outcomes of the course by choosing relevant learning activities
• Define and point the evaluation activities (diagnostic, formative, summative evaluation), their characteristics and frequency
• Take into account the work load each activity or group of activities imply for teachers to prepare and students to follow

Workshop's materials
• 6 different coloured cards presenting on one side a brief description of the types of learning activities and on des other side ideas et examples of activities that can be done with or without ICTs
• A document with several activities where learning is visible and may or may not be assessed
• A document where teaching teams are invited to note the main learning outcome of their course
• A graph that can represent the state of the course before redesign-it and a comparative vision of it afterwards.
• An A1 paper sheet used as a board for designing the course with the cards
• Pens, coloured stickers, patafix

Perquisite for the full version of the workshop
• The intended learning outcomes of the course
• The outcomes to be evaluated

Running the workshop
Some theory:
Before starting the collaborative work between the members of each team, we propose a very quick overview of few points needed to be taken in consideration.
Which posture teachers need to have? Which questions teacher should ask while thinking and designing a course?
Based on the cognitive sciences framework of constructivism and socio-constructivism, learners build their knowledge progressively through mental and cognitive processes. How does this framework impact the students' learning? And what about the learner himself? University student is placed between the adolescent and the adult. He already has the adult reactions, he considers already the cost/benefit ratio before committing, he has previous experience, he seeks the professional skills and competences needed, he takes less risks and he is more receptive to the internal motivation.
For better understanding the workshop, is important to present the main principles, the research outcomes that shape this workshop. Issued from the book of Diana Laurillard "Teaching as a design science":
• A student-orientated approach to teaching
• An active learning
• Blended learning

• Assessment

Practice / Steps:
    • The facilitator presents the 6 cards with the different types of activities and the participants are invited to concert for writing the main objective of their course
    • If they work on an existing course, they are invited to mark on a graph the types of activities that dominate the course at its present form as well the format of the course in a scale between face to face course and totally online. This description is the departure image of the course to be redesigned
    • From this moment on, participants work on the A1 sheet board for designing their course. By taking in account their didactic needs, teams are looking for the learning activities types they agree to propose for offering an active learning to their students. The cards are arranged in groups for creating learning sequences.
    • Afterwards the cards are turned over and the participants select or add to the cards the learning activities.
    • Participants highlight the activities to be assessed (diagnostic and formative, summative evaluation)
    • The activities or blocks of activities designed are connected to the learning outcomes of the course
    • Participants are also invited to estimate the time needed for the selected learning activities.
    • During the process of designing, the course facilitator highlights the main principles of the instructional design as the constructive alignment or Bloom's taxonomy
    • The designed storyboard is agreed as a representation of the course the team wants to build and this new version is compared to the previous one if exited.

ABC design

The designed course with ABCD was run during the last semester. At the end of the course an evaluation form was sent to the students. The results and general appreciation of the proposed activities were very positive.

The team designed activities from all the five types, acquisition, production, inquiry, discussion, collaboration. This plurality of the proposed typology of pedagogical activities was encouragingly commented and revealed in a question about "your favourite learning activity" the plural choices of the students.

• Quel type d'activité vous a plus plu ? donnez des exemples

le projet final

Lire et comprendre des articles scientifiques pour ensuite les résumer

L'activité sur les cartes

La géodésie, l'étude des cartes

Le projet. Il est très intéressant d'avoir une problématique fixée puis d'être entièrement libre dans ses choix par la suite, tant que nous sommes en mesure de les justifier.

"final project", reading and comprehension of scientific articles…" "the cards activity"…

What was actually done

The teaching team put in place a more active teaching including different kind of activities especially inquiry type activities. The design of the course started last November. The implementation finished for January 2019 and the course run last spring's semester.

Going through the results and comments of the evaluation, we realised that the students, even if they found the learning outcomes clear, would like that information to be clear during the semester for all the learning activities proposed.

What support was required/provided

The teaching team dedicated quite an amount of time after the workshop for redesigning their course. The course existed already but the team that took the responsibility reviewed and redesigned completely the teaching.

The face to face hours remained the same but there were less acquisition activities and much more inquiry, discussion and collaborative ones. For example, during the face to face session the acquisition activity was watching and studying together a scientific video of 10-12 minutes. Afterwards, students were divided in small groups and worked together for examining written resources, agree on the information to provide and produced a recapitulative document. The teacher gave feedback for each production and validated the scientific information.

For this course, in terms of re-design, the major change was done before January and several points were prepared during the semester.

Impact and evaluation

At the end of the semester, June - July, an evaluation questionnaire was sent for students to evaluate the course, the activities, etc. The results were very positive.

72% found the teaching unit well organised and the expected learning outcomes clearly enounced. 85,7% of the students that answered declared that the content corresponded to their expectations, the progression and rhythm of the course were appropriate. Equally 85,7% of the students estimated the design of the course promoted the active participation of the students. All students declared that the learning activities helped retaining their motivation and the "active" learning was interesting and helpful for them.

This positive evaluation is also visible within the results of the final exams. Comparing the results of the last years we observe important improvements of the students grades at the end of last year's exams and the fact the intended learning outcomes were achieved in a large scale. This is due also to the fact that the evaluation procedure changed a lot: while in the previous years only the technical competences were evaluated in a final exam, in the new lecture it has been replaced with a final project which evaluate a higher number of and diverse competences.
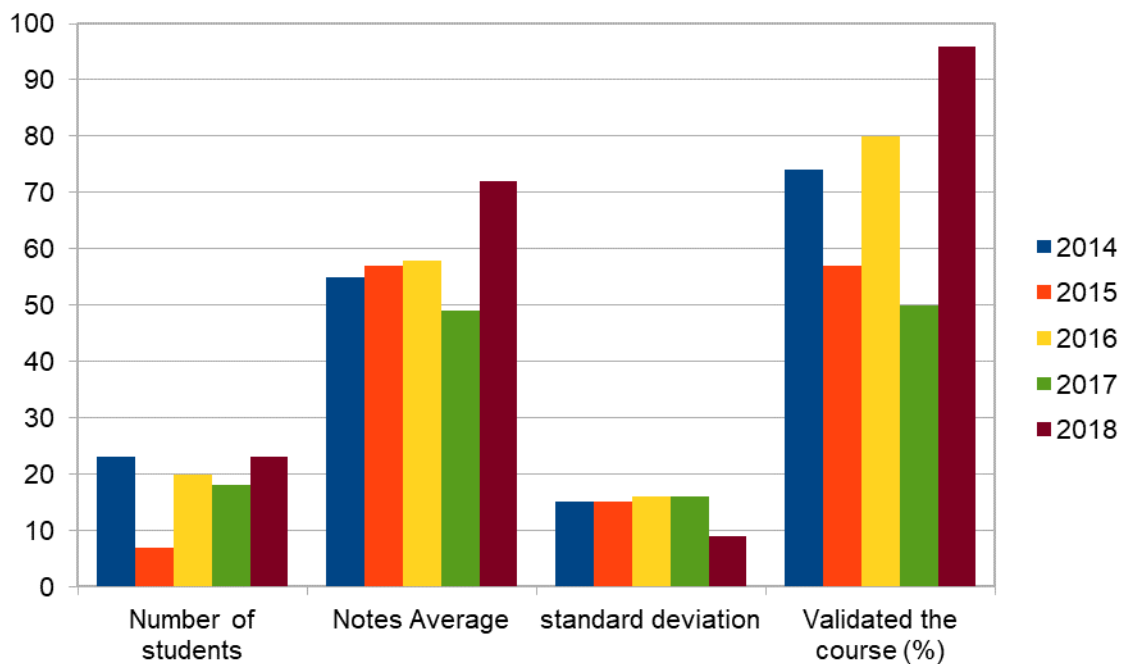
Besides the students' survey and feedback, we observe a more important activity in the course via the moodle analytics and there is a higher number of students doing self-evaluation tests.

Successes and lessons learnt

The ABCD workshop (Activity Based Activity Design as we renamed the workshop) and especially the cards allow an important flexibility while designing a teaching unit

Each team can use the cards for proposing the design of the course and decide how depth (macroscopic or microscopic level of designing) on planning the activities they wish to go

The teacher responsible for this course talked about the method and workshop : "The different kind of activities proposed by the cards help to formalize the sequence of activities in a coherent way, to balance the types of activities during the sequence, to be in agreement with the pedagogical outcomes of the lecture and to choose an adapted evaluation. The lecture then took a very different form than the previous traditional form: acquisition / production activities. The form of the ABCD workshop is playful and helps to be creative in the type of designed activities. It helps to focus more on the pedagogical objectives of the lectures, and find naturally an adapted evaluation, which will evaluate a broader type of competences rather than focus the evaluation only on the technical content of the lecture as it was before. Moreover, the cards helped to discuss between colleagues within the team, to exchange and foster ideas, in a playful way".

Further changes from the today's version of the workshop would be its association with a blended course we prepare and the introduction of a more systematic evaluation of the time, teacher's time and student's time for the proposed activities.

Scalability and transferability

The ABCD workshop is part of the official catalogue of training on course design. We run the workshops on demand and they are adapted to the needs of each teaching team.

Within a larger project of redesigning several courses for more blended formats the ABCD designing method will be one of the main activities the teachers or teaching teams would have to see or actively participate.

Further Information

Here are two examples of design of 2 sequences of the course

First example:

PSP: Cours 1

Navigation et positionnement

Objectifs du cours

Après les activités de "navigation et positionnement", l'apprenant·e saura:

- décrire différentes méthodes de positionnement sur Terre :
  - détermination de la latitude avec un sextant
  - détermination de la longitude avec une horloge
  - détermination de la position par multilatération
  - détermination de la position par trilatération

- analyser les besoins en positionnement pour une application donnée et concevoir les caractéristiques d'un système adapté à ces besoins; concevoir une décomposition fonctionnelle et estimer un calendrier afin d'étudier ce système plus en détails

Déroulé du cours

1 – *Acquisition* : exposition du cadre du cours n°1 (5')

Objectif général : éplucher et reconstruire un système de positionnement par satellites

Cours actif : ensemble d'activités (tutoriels, enquête, études de documents, mini-projet) à faire par les étudiant·e·s. Les étudiant·e·s ne restent pas passifs mais apprennent en faisant.

Moodle : les objectifs, activités et évaluations propres à chaque séance sont disponible 1 semaine avant la séance sur le site Moodle.

Évaluations : les évaluations peuvent ou pas être notées (formative ou certificative).

- Note d'implication (présence en cours) : 20%
- Note sur les productions (devoirs maison) : 30%
- Note présentation au dernier cours : 50 %

2 – *Acquisition* : Vidéo sur l'histoire de la navigation (15')

Du Kamal au GPS (vidéo de 12 mn)

3 – *Activité* : enquête sur les méthodes de navigation (1h30)

Analyse de cas historiques et actuels (4 groupes – sextant latitude, horloge longitude, multilatération LORAN, trilatération WIFI et satellites)

  a. *Enquête (15')* : choix des groupes et lecture de l'enquête
  b. *Collaboration (15')* : trouver un consensus

  c. *Production (15')* : établir la fiche récapitulative
  d. *Acquisition (45')* : restitution/présentation des fiches et résumé de l'enseignant [objectif : avoir une fiche claire sur chaque outil historique]

4 – *Activité* : Déterminer les sous-systèmes à étudier dans l'UE (40')

  a. *Acquisition (5')* : vidéo sur le système Galileo (« Completing the constellation »)
  b. *Enquête/Collaboration (10')* : éplucher un système de positionnement en sous-systèmes. Les étudiants imaginent, à partir de la brochure de l'ESA sur Galileo, quels sont les sous-systèmes composant Galileo et ses caractéristiques
  c. *Production (10')* : listing au tableau par l'enseignant·e avec les suggestions des étudiant·e·s, en liant caracs et sous-systèmes
  d. *Acquisition (15')* : Retour avec enseignant et établissement du plan du cours. Distribution du poly de cours. Indiquer les chapitres à lire pour la séance suivante → chapitres 1 et 2

5 – *Activité* : Visite de la bibliothèque (30')

Vitrine avec le sextant de marine de Brunner, le bâton de Jacob, des chronomètres de poche.

Second example:

PSP: Cours 2
Orbites

Objectifs du cours

Après les activités de "orbites", l'apprenant·e saura:

- pour la rubrique de 'physique d'orbites' :
    - o définir 'orbites' et nommer les applications de satellites artificiels en orbite ;
    - o nommer les lois de physique concernés ; et
    - o utiliser les équations de cinétique et dynamique orbitaux avec AN.
- pour la rubrique de 'type d'orbites' :
    - o lister des différents types d'orbites en fonction de sa hauteur ;
    - o décrire ses caractéristiques ; et
    - o identifier l'orbite adaptée selon la mission de satellites.
- pour la rubrique de 'éléments orbitaux'
    - o définir le système de coordonnée équatorial utilisé pour les satellites de navigation
    - o lister les 'éléments orbitaux'
    - o calculer (à l'aide des logiciels existants) des paramètres d'orbites à partir des produits GNSS
    - o lister les sources de perturbations de l'orbite et estimer son ordre de gradeur

Déroulé du cours

1 – *Acquisition* : exposition de la physique d'orbites (40')

- Quelques faits historiques
- Loi de gravitation
- Les lois de Kepler
- Manipulation d'une orbite elliptique : position, vitesse, énergie, ...
- Équation de Kepler
- AN : orbite géostationnaire

2 – *Activité* : où se trouve ces satellites ? (50')

Analyse (en 3 groupes) des 3 types d'orbites : GEO, MEO, et LEO, et placer les satellites pertinents dans le type d'orbite choisi

Doc : Poster 'GEO, MEO, LEO... et les autres' de CNES, et 'Quelques satellites passés et présents'

- a. *Enquête (10')* : choix des groupes et lecture de l'enquête
- b. *Collaboration et Production (10')* : trouver un consensus et établir la fiche récapitulative
- c. *Discussion (30')* : restitution/présentation des fiches et résumé de l'enseignant

3 – *Activité* : calculs de l'orbite de transfert de Hohmann (30')

- a. *Acquisition (30')* : Présentation de l'enseignant des idées générales et application sur un GTO
- b. *Pratique et production* (devoir à rendre la semaine suivante) : calculer des éléments de l'orbite de transfert pour GALILEO 5 et 6

4 – *Activité* : éléments orbitaux (60')

- a. *Acquisition (20')* : présentation par l'enseignant sur le système de coordonnée équatorial et les éléments orbitaux
- b. *Pratique (20')* : calculer et tracer les paramètres d'orbite à partir des données GNSS
- c. *Discussion (20')* : présentation des résultats et discussion sur les sources de perturbations

Annonce des lectures (sur Moodle) pour la séance suivante.