Use of flip learning to teach Graphs Theory in Higher Education

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Introduction

- IX Survey of Social Perception of Science and Technology (FECYT, 2018)
Introduction

Educational performance in science and mathematics

- PISA report (OECD, 2016):
  - Scientific competence: the ability to interact with issues related to science and the ideas of science, as a reflective citizen.
  - Mathematical competence: the ability of the individual to formulate, use and interpret mathematics in different contexts. It includes mathematical reasoning and the use of concepts, procedures, data and mathematical tools to describe, explain and predict phenomena.

Spain:

- 493 points in science: level 3 (equal to the OECD average)
- 490 points in mathematics: level 3 (4 points less than the OECD)
- 28.3% of students in the 4th year of Secondary Education aspire to study science subjects.
Introduction

Scientific Education Crisis: For students used to obtain information immediately, classes become boring and it is difficult to maintain their attention. This leads to reasoning and deduction tasks being costly to carry done by the students.

"Students are not motivated because they do not learn and they do not learn because they are not motivated" (Pozo & Gómez, 2006, p.45)
Flip Education:

- "Peer instruction" (Crouch & Mazur, 2001) and "just in time teaching" (Novak & Gavrin, 1999).

- Work at home through ICT:
  - Principles of ICT in the teaching of mathematics (Rojano, 2003): Didactic, Specialization, Cognitive, Pedagogical and Equity.
  - Integration of ICT: Nested and Woven (Sánchez, 2002).


- Case of mathematics:
Objectives and type of investigation

Objectives:

- To facilitate a better and deeper apprehension of the mathematical concepts to be studied by the students.
- To enhance verbal participation in the classroom: space for discussion.
- To encourage students to study continuously.
- To increase student's motivation towards the learning of mathematical concepts.
- To analyse student perceptions on the use of this methodology.
Objectives and type of investigation

Type of investigation:

- **Object**: applicate
- **Deepening level**: exploratory
- **Type of data**: quantitative
- **Manipulation of variables**: pre-experimental
- **Type of inference**: inductive
- **Time**: transversal
Methodology

- Sample and design:
  - 54 students of GMA of Computer Engineering UPV.

- Design: Pre-experimental.

- Procedure:
  - Links at Polimedia: videos, exercises to solve, to possible controls type test and the content to work throughout the face-to-face sessions (outside the classroom).
  - Resolution of questions about the material (classroom).
  - Solving individual and group problems (outside the classroom).
  - Evaluation survey.
Methodology

Information collection tools: Likert-Type questionnaire (1-5). Items are the independent variables:

1. Flip methodology (to watch videos at home and to use class time to clarify concepts and solve exercises) helps my learning.
2. To know the contents to work in class previously to the lesson favors my learning.
3. The video clips of the subject are useful.
4. The controls in PoliformaT (and the necessary preparation before solving them) enables to have a better knowledge of the subject.
5. The exercises proposed weekly have helped me to understand better the subject and keep it up to date.
6. The resources in PoliformaT haven been useful in my learning process.
7. The rhythm followed in class has been adequate.
8. The teacher-student interaction generated by the flip methodology has helped my learning.
9. The teacher makes comments about the activities which are useful for my learning.
10. The teacher explains the subject well.
11. The teacher strives to make the subject interesting.
12. The teacher strives to help me with my difficulties in the subject.
13. My ability to work in groups has improved.
14. My reasoning and analysis capacity have improved.
15. My ability to express myself correctly in scientific language has improved.
16. I am satisfied with the quality of the subject

Data analysis: Descriptive analysis and analysis of correlations (Spearman's Rho) according to preference for Flip or not.
Results and discussion

Descriptive Analysis

- % qualifications in GMA
### Results and discussion

#### Descriptive Analysis

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MEAN</th>
<th>SD</th>
<th>ITEM</th>
<th>MEAN</th>
<th>SD</th>
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<td>Flip methodology (to watch videos at home and to use class time to clarify concepts and solve exercises) helps my learning.</td>
<td>4.12</td>
<td>0.35</td>
<td>The teacher makes comments about the activities which are useful for my learning.</td>
<td>4.44</td>
<td>0.34</td>
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<td>To know the contents to work in class previously to the lesson favours my learning.</td>
<td>4.12</td>
<td>0.41</td>
<td>The teacher explains the subject well.</td>
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<td>0.35</td>
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<tr>
<td>The video clips of the subject are useful.</td>
<td>4.38</td>
<td>0.20</td>
<td>The teacher strives to make the subject interesting.</td>
<td>4.74</td>
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<td>The controls in PoliformaT (and the necessary preparation before solving them) enables to have a better knowledge of the subject.</td>
<td>3.79</td>
<td>0.11</td>
<td>The teacher strives to help me with my difficulties in the subject.</td>
<td>4.56</td>
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<td>The exercises proposed weekly have helped me to understand better the subject and keep it up to date.</td>
<td>3.85</td>
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<td>My ability to work in groups has improved.</td>
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<td>The resources in PoliformaT haven been useful in my learning process.</td>
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<td>0.08</td>
<td>My reasoning and analysis capacity have improved.</td>
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<td>The rhythm followed in class has been adequate.</td>
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<td>0.07</td>
<td>My ability to express myself correctly in scientific language has improved.</td>
<td>4.12</td>
<td>0.36</td>
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<td>The teacher-student interaction generated by the flip methodology has helped my learning.</td>
<td>4.15</td>
<td>0.23</td>
<td>I am satisfied with the quality of the subject</td>
<td>4.27</td>
<td>0.14</td>
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</table>

Global: 4.19 0.26
## Results and discussion

### Correlation Analysis

<table>
<thead>
<tr>
<th></th>
<th>Exer.help</th>
<th>T-S interac.</th>
<th>Tcom. help</th>
<th>Texplians well</th>
<th>Tmakes subject interest</th>
<th>Thelps diffic.</th>
<th>Satisfac. quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flip helps learning</strong></td>
<td>C.C.</td>
<td>.758*</td>
<td>.593*</td>
<td>.395</td>
<td>.291</td>
<td>.465*</td>
<td>.043</td>
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<td></td>
<td>Sig.</td>
<td>.000</td>
<td>.000</td>
<td>.021</td>
<td>.095</td>
<td>.006</td>
<td>.809</td>
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<td><strong>To know contents previously</strong></td>
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<td>.121</td>
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<td>.795</td>
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<td>.750</td>
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<td><strong>Exercises help</strong></td>
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<td>1.000</td>
<td>.514*</td>
<td>.374</td>
<td>.208</td>
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<td>-.109</td>
<td>.269</td>
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<td>.270</td>
<td>.454*</td>
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<td>1.000</td>
<td>.502*</td>
<td>.436*</td>
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<td>.002</td>
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<td>.010</td>
<td>.082</td>
<td>.156</td>
</tr>
<tr>
<td><strong>Tcomm. help</strong></td>
<td>C.C.</td>
<td>.374</td>
<td>.502*</td>
<td>1.000</td>
<td>.578*</td>
<td>.461*</td>
<td>.460*</td>
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<tr>
<td></td>
<td>Sig.</td>
<td>.029</td>
<td>.002</td>
<td>.001</td>
<td>.000</td>
<td>.006</td>
<td>.006</td>
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<tr>
<td><strong>Ability to express improved</strong></td>
<td>C.C.</td>
<td>.225</td>
<td>.338</td>
<td>.542*</td>
<td>.179</td>
<td>.162</td>
<td>-.063</td>
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<tr>
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<td>.050</td>
<td>.001</td>
<td>.312</td>
<td>.360</td>
<td>.722</td>
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</table>
Conclusions

Advantages:

◦ Students have evaluated very positively the role of the teacher as well as the disposal of the material to study before the class.

◦ Improvement of verbal expression, work at your own pace and teacher-student relationship

◦ Increase in motivation.

◦ Greater workload but sharing the smaller global effort, linked to the like for methodology and the environment.

◦ Manipulation of the concepts in experiences for the phenomenological treatment (Rojano, 2003).

◦ In the face-to-face session it is the second time that the subject is approached, which allows the student to be more critical and to be able to participate more easily in the discussion.

◦ Solving questions orally helps to improve their ability to communicate orally.

◦ The class is more conducive.

◦ The habit of studying on a daily basis is encouraged.
Conclusions

Requirements and limitations:

- Clear and attractive materials and detailed programming (Jordán, Pérez and Sanabria, 2014).
- Test before each session, if there is a lack of work at home.
- Do not do on correlative days.
- All students have to participate.
- Level of achievement depends on the degree of involvement: lack of habit, reticence, time. (Bishop and Verleguer, 2013).
- Teachers' effort.
- We find students who study periodically who prefer to follow their rhythm of study.
- Encourage group participation in the classroom through the implementation of some collaborative methodologies.
References


Bergmann, J.; Sams, A. (2012). Flip Your Classroom: Talk to Every Student in Every Class Every Day; International Society for Technology in Education: Washington, DC, USA.


References


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THANKS FOR YOUR ATTENTION