

Cooperative Micro Flip Teaching

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Abstract. This work integrates two aspects whose positive impact on learning has been tested flip teaching and cooperation among students. In this proposal the faculty/students of a subject use, throughout the flip teaching technique, the resources created by students of a different degree. The theme of the resources is about teamwork competence, topic in which students create and later use the resources. The paper describes how to use and organize the generated and shared resources by the students, using the proposed teaching/learning methodology that is so called Micro Flip Teaching. Also, the results of the students' usefulness perception are presented.

Keywords: Flip Teaching · Cooperation · Knowledge management system · Educational innovation

1 Introduction

Flip Teaching methodology is based on two key actions: move at home the activities that are usually done in the classroom (such as master lectures); and move into the classroom those that are usually done at home (like homework). Traditional education is based on lectures where the teacher acts as the emitting source of knowledge and students as passive recipients. Moreover, in carrying out academic works, students have an active role, whether they are individual or collective works. According to this, Flip Teaching implies, on one hand, taking advantages from the presence of faculty and students in a common location (e.g. the classroom) to achieve an active participation, because of an authentic interaction in the classroom is the basic element for active learning. The ideal environment for active learning should motivate students to interact, perform activities, and reflect on their learning [1]. On the other hand, Flip Teaching looks for that students at home emulate the behavior they usually have in the classroom.

The first proposals being made to bring the lessons home and work in the classroom, emerged in 2000. Lage et al. [2] call this technique “Inverting the classroom”,

while Baker [3] names it “Classroom Flip”. Ever since there have been new names like “Flip Teaching”, “Flipped Classroom” or “Flipped Learning”.

Although there is no common model for application of this technique [4], there exist lots of works that use the video as a substitute for the master lecture. However, there is no uniformity in the activities undertaken in class. It can be said that this “inversion” of times can help to optimize spaces for discussions, debates, laboratories, projects, practical activities in class, and the fostering of collaboration. The four pillars that make Flip teaching possible are flexible environments, learning culture, intentional content, and professional teachers [5]. The Observatory of Education Innovation of the *Tecnológico de Monterrey* [6] has also detected a tendency to integrate inverted learning with other approaches, for example, combining peer instruction [7], self-paced learning according to objectives, adaptive learning [8–10], and the use of leisure to learn.

Thus, Flip Teaching model is based on the idea of increasing interaction among students and their responsibility for their own learning [11], using virtual learning environments as supported tool [12–14]. These virtual environments allow students the access to the learning resources and the possibility to make questions and interchange materials throughout the forums, because it is mandatory that the students have availability of help at home [15].

With this regard, students often share learning resources with their peers through social networks [16]. Teachers can take advantage from this situation organizing these shared resources and stimulating their production. Some research works have shown that resources production means a stimulus for students, as a way to explain their experience relating to a specific subject or the context where learning occurs [17]. Also, the use of contents created by students stimulates the creation of new resources by themselves. Thus a spiral is established where contents are produced, classified, organized and used [18].

Most of the Flipped Teaching experiences reviewed by the authors showed that the typical out of the classroom activities are based on videos, most of them created by the faculty. It is less common, but some teachers also use external videos to the academic scope.

The approach of this work is based on the use, under the model of “Flip Teaching”, of students’ produced resources in order to analyze the students’ perception on the usefulness of these resources.

This way, the main novelty of this work is that out the classroom activity is based on videos provided by both faculty and student (to substitute the master lectures) and online resources (generated by the students as supplementary learning material). All this by establishing criteria for integrating the resources, generated by students, with those generated by teachers.

The research done with this experience contributes with:

- A study of the resources that students create for each of the situation, which generates a continuous knowledge. It includes its format, scope and usefulness.
- Identification, study and analysis of the learning activities where the created resources may be involved. Besides, there are activities that integrate both faculty’s resources and students’ resources.

- A qualitative study of the students’ perception about the learning improvement throughout the use of the generated resources.
- A qualitative study of the willingness to share their learning resources with others peers.

The rest of the paper is organized as follow. Section 2 presents the proposed Flip Teaching model. Section 3 explains the research context. Section 4 discusses the results. Finally, Sect. 5 closes the paper with its conclusions.

2 Flip Teaching Proposed Model

In this paper a Flip teaching method has been defined and it is so called Micro-Flip Teaching (MFT). The feature of this model is that it is not necessary to apply it to the whole subject. Its application is simple with easy to follow notes. It uses free cloud-computing accessible technologies, such as Screencast, Dropbox or Drive. The model has been tested with a positive impact in the learning improvement [19].

MFT model has three stages, as it is shown in Fig. 1: (1) Outside the classroom activity; (2) Binding activity; and (3) Inside the classroom activity.

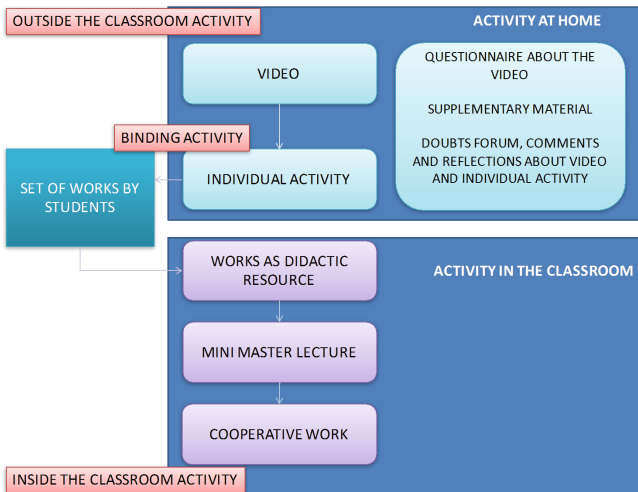


Fig. 1. Micro Flip Teaching (MFT) model

2.1 Activity at Home

It really is an activity that takes place outside the classroom, although termed “at home”. The aim is not to transfer the full master lecture, but the most significant of the same through a video lasting no longer than ten minutes. The reason is that there are cognitive studies demonstrating the novelty of any stimulus tends to disappear after ten minutes [20]. Moreover, each video has an associated questionnaire to verify that students have seen the video; a forum for questions, comments and reflections (simulates the doubts that may arise during a class) and supplementary material.

2.2 Binding Activity

It is a key activity to establish a connection between the activities inside and outside the classroom [21]. This activity consists of making an individual work where students apply the explained concepts in the outside the classroom activity. Works are sent to the faculty for correction or they are published in a shared forum with all the students. This activity's duration is thirty minutes.

2.3 Activity in the Classroom

Faculty knows the doubts previously (through the forum available on the activity at home) and the degree of learning of such terms (through the work done in binding activity). From that prior knowledge the activity in the classroom is structured in a series of steps:

- Step 1. The results of the work of the binding activity are used as a teaching resource (both those that are well designed as the rest). Students present the work, after that a discussion begins about the reasons why it is right or wrong. Running time twenty minutes.
- Step 2. The faculty gives a mini master lecture for ten minutes.
- Step 3. Cooperative work where the learning resources generated until that moment are used. The duration is thirty minutes.

This model takes into account the knowledge that is used during the activity at home and that was generated previously by other students; specifically, as “master lecture” and “supplementary material”.

The method can be used with the support of any Learning Management System because it is used as a driver of the process (resource management, forums, etc.).

3 Research Context

This research has been done during 2015–2016 academic year in the Programming Fundamentals subject of the first year of the Biotechnology degree in the Technical University of Madrid. This subject is taught in the first semester and was followed by sixty students.

The resources used for this case were created by students of the subject of Informatics and Programming for the previous academic year 2014–2015. This subject was taught in the first year and belongs to the degree of Engineer of Energy of the Technical University of Madrid.

The MFT method was applied for the development of teamwork competence (TWC) of the students in the 2015–2016 academic year. Thus, TWC was the theme of the created resources by the students the academic year before, also regarding the development of the TWC.

Figure 2 shows how the generated resources are integrated in the activity in the classroom by both faculty and a selection of students and, as supplementary material, students may access to the stored resources in a knowledge management system called

BRACO (*Buscador de Recursos de Aprendizaje Cooperativo*) [16, 22]. It is a system that allows storing, identifying, organizing and searching knowledge using ontologies. It is characterized by its capacity of converting individual or grouping knowledge into organizational knowledge [23].

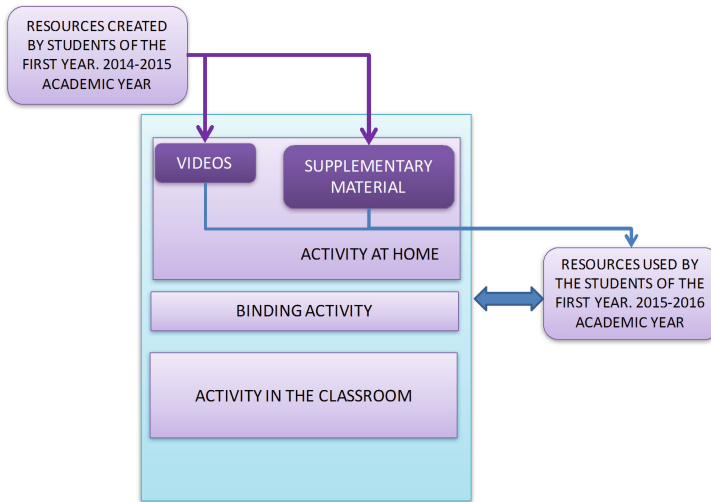


Fig. 2. Model applied on experience

Students make the binding activity organized in teams and each activity corresponds with several stages of the TWC development. People that compose the team interact among them through forums, wikis and online storage systems. This way, faculty may have evidences enough to follow the advances and to finally evaluate the TWC. This method is called Comprehensive Training Model of the Teamwork Competence (CTMTC) and has the main property of allowing faculty teach and evaluate the TWC both individually and by-group [24, 25].

The activity in the classroom is based on the use of the outcomes of the teamwork (TW) as didactical resource. Student teams expose the way they have done a specific TW stage and its outcomes. Faculty and the rest of the students make questions, reflect or contrast the presented outcomes with their own outcomes.

Teacher's role is based on how to use the students' expositions as didactical resource; for example, teacher may explain the reasons of the mistakes and may correct them in a public way. The others student teams use the exposed works to modify their own works. After that, a mini master lecture about the next TW stage is done. The process continues during four more sessions till the end of the TWC development.

The results presented in the next section correspond to two different studies. The first was made with students that created and shares the resources during 2014–2015 academic year and the second was made with the students that used those resources during 2015–2016 academic year.

4 Results

4.1 Resources Generated by Students in 2014–2015 Academic Year

Sixty students participated in this experience. They were organized in ten work teams with six people by team. Six teams generated useful resources and the others did not generate resources or the resources generated were not valid due to low quality issues (considered by the faculty evaluation of the work done).

The six teams have created thirty-nine resources whose typology is presented in Table 1. All these resources have been used in the activity at home in the following way:

- Nine resources have been integrated, alongside the teachers' ones, in the Learning Management System used in the subject (Moodle platform).
- Thirty-nine resources are accessible for the students, as supplementary material, in BRACO knowledge management system.

Table 1. Generated and shared contents in 2014–2015 academic course

Number and type of generated and shared by the students	
Videos (explanations of TW development and of the TW itself)	12
Web site (final result of TW)	6
Files (results of the intermediate stages of TW)	21

4.2 Students' Perception of the Use of the Resources in 2015–2016 Academic Year

In the academic course 2015–2016, once completed the training process and before the teachers carry out the evaluation, a survey among the participating students was conducted. The survey was voluntary and from a population of sixty students answered it fifty-five.

The survey has twenty-seven questions about the development of TWC and the students' profile, organized in the following way: four questions about Learning-Enthusiasm-Organization; eight questions about the Contents; two questions about Evaluation-Workload; five questions about their general opinion of the subject development; and eight questions about participant's characteristics. Some questions use a Likert scale 1–5, (1- Completely disagree; 2- Somewhat agree; 3- Neither agree nor disagree; 4- Sufficient agree; and 4- Strongly agree).

Table 2 shows the ration of the received answers regarding the questions about how the students used, in the activity at home, the created resources that were available in a web site, alongside with other teachers' materials. Tables 3 and 4 present the questions related to BRACO system (where the supplementary material was organized). It is attempted to measure the ease of access to supplementary material and its usefulness when performing the different stages of TWC development. Finally, it is asked for the intention of students to share the resources that they have created with others, see Table 5.

Table 2. Using videos of teachers and students in 2015–2016 academic year

Q5. Indicate the degree of agreement with the following statements (%):					
	1	2	3	4	5
I have seen works in the recommended web site before I started TW	0	2	4	55	40
I think the works in the recommended web site have been useful to decide the TW theme	2	7	24	40	27

Table 3. BRACO resources used in 2015–2016 academic year

Q7. Indicate the number of resources that have seen among those found through BRACO:	
	%
None	4
Between 2 and 4	31
Between 5 and 7	45
More than 7	20

Table 4. Ease and usefulness of BRACO in 2015–2016 academic year

Q10. Express your level of agreement with the following statements about the impact of the contents of BRACO in the development of teamwork (%)					
	1	2	3	4	5
BU1. I have found easy to access BRACO resources	2	4	20	55	16
BU2. I have found BRACO useful for the phase “Mission and objectives”	2	5	13	55	25
BU3. I have found BRACO useful for the phase “Normative”	4	2	15	53	27
BU4. I have found BRACO useful for the phase “Responsibilities map”	4	4	22	49	22
BU5. I have found BRACO useful for the phase “Timetable”	4	4	27	45	20
BU6. I have found BRACO useful for the phase “Implementation phase”	4	5	24	49	18
BU7. I have found BRACO useful for the phase “Storage”	5	16	40	35	4
BU8. I have found BRACO useful for the phase “Final result”	7	7	16	40	29

Table 5. Resource sharing

Q12. With whom would you share in the future the resources you have created during the development of TW?	
	%
With my friends	5
With other teams of my teaching group	18
With other teams of my degree	24
With other teams of other degrees	3
With who ask me resources	50

5 Discussion

As in other previous research works, it has been demonstrated the usefulness of students create, share and use resources that have been previously created by other students (peer content creation) [17]. This case about knowledge creation demonstrates that students is able to create useful resources in different formats (video, web pages and files), which improves their learning. Moreover, students have willingness to share resources (50 % share with anyone and 24 % with the same degree). Both creation and sharing of resources brings benefits to student learning [26]. Sharples et al. [27] mention to Sidney Pressey (author of “Psychology and the New Education”, 1933) that affirms that “Pupils are saved, in the words of Pressey, from educational drudgery and incompetence by joining online communities, asking questions, seeking answers, creating and sharing resources”. Therefore, it must be strengthened by faculty the creation, organization and use of these resources.

Students were asked with which groups they would shared the resources they have created. They were allowed only one choice in order to know their preferences. 50 % of students would share their resources with anyone who asked them and 3 % would share it with other degrees, compared with 24 % who would share with their same degree partners. This situation is shocking because these students have used resources created by students from another degree. For this reason, it is key that the generated knowledge will be managed through a knowledge management system that all students in the same organization can access, to prevent the sharing of resources depends on “if they ask me a resource or not”. This is possible in the presented proposal and a BRACO ontology has been defined depending on the degrees where the knowledge is created.

With regard to the use of the recommended web site outside the classroom, where the resources of both faculty and students are integrated, the 94 % of students recognizes that used it. The impact of this resource usage has been significant, for example, the 67 % of the students has been conditioned to choose the type of work to be done.

In relation to the rest of the resources used by students, and accessible as supplementary material through BRACO, it is shown that they have used it. Only 4 % of students did not use any resources, however 96 % have used some of these resources

and 65 % used five or more resources. Therefore, it demonstrates that students use the resources generated by students of other degrees.

Regarding the use of resources on a particular stage of teamwork, in all phases except one, between 65 % and 80 % of the students recognized that the students' generated resources stored in BRACO have been useful or very useful for them.

For the "Storage" phase, only 39 % of students have seemed useful these resources; it will be necessary to consider whether the provided materials do not help in that task or whether the students already have sufficient knowledge and they do not need additional support. Therefore, teachers must analyze these resources and find out the reason of this. This leads to the conclusion that a measuring tool of the usefulness should be used in order to promote and review the resource creation in those parts of the subject where exist the perception that they have not been helpful.

6 Conclusions

It has shown the organization of resources created by students in order to used them for students of other degrees throughout the Micro Flip Teaching method, including both individuals and grouping activities in which ones the resources are useful and suitable. Also, the students' positive perception regarding the effect of the use of these resources in their learning has been studied. Moreover, other important contribution of the research done is the students' good willingness to share the created resources, but still it is necessary to work to improve it.

This method is easily transferable to any subject regardless of the discipline taught. In addition, it can be used in a timely manner in those parts of the subject where students have poorer academic results or there will be more complex topics.

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References

1. Felder, R.M., Brent, R.: Active learning: an introduction. *ASQ High. Educ. Br.* **2**, 1–5 (2009)
2. Lage, M.J., Platt, G.J., Treglia, M.: Inverting the classroom: a gateway to creating an inclusive learning environment. *J. Econ. Educ.* **31**(1), 30–43 (2000)
3. Baker, J.W.: The 'classroom flip': using web course management tools to become the guide by the side. In: Chambers, J.A. (ed.) *Selected Papers from the 11th International Conference on College Teaching and Learning*, pp. 9–17. Florida Community College at Jacksonville, Jacksonville (2000)
4. CCL GUIDE: Learning story. Flipped classroom. What is the flipped classroom model, and how to use it? University of Minho, Portugal (2013). http://creative.eun.org/c/document_library/get_file?uuid=b0845def-9c31-476d-a3be-52a04c1e23a0&groupId=96459. Accessed 18 Feb 2016

5. Ramírez-Monoya, M.S., Ramírez-Hernández, D.C.: Inverted learning environments with technology, innovation and flexibility: student experiences and meanings. *J. Inf. Technol. Res.* **9**, 18–33 (2016)
6. Observatory of Educational Innovation of the Tecnológico de Monterrey: Flipped Learning. Tecnológico de Monterrey (2014). <http://observatorio.itesm.mx/edutrendsaprendizajeinvertido>. Accessed 25 Feb 2016
7. Fulton, K.P.: *Time for Learning: Top 10 Reasons Why Flipping the Classroom can Change Education*. Corwin Press, California (2014)
8. Lerís López, D., Vea Muniesa, F., Velamazán Gimeno, Á.: Aprendizaje adaptativo en Moodle: Tres casos prácticos. *Educ. Knowl. Soc.* **16**, 138–157 (2015)
9. Berlanga, A., García-Peñalvo, F.J.: Learning technology specifications: semantic objects for adaptive learning environments. *Int. J. Learn. Technol.* **1**, 458–472 (2005)
10. Berlanga, A.J., García-Peñalvo, F.J.: Learning design in adaptive educational hypermedia systems. *J. Univ. Comput. Sci.* **14**, 3627–3647 (2008)
11. Bergmann, J., Sams, A.: *Flip Your Classroom: Reach Every Student in Every Class Every Day*. International Society for Technology in Education, New York (2012)
12. García-Peñalvo, F.J., García Carrasco, J.: Los espacios virtuales educativos en el ámbito de Internet: Un refuerzo a la formación tradicional. *Educ. Knowl. Soc.* **3** (2002)
13. García-Peñalvo, F.J.: *Advances in E-Learning: Experiences and Methodologies*. Information Science Reference (formerly Idea Group Reference), Hershey (2008)
14. García-Peñalvo, F.J., Seoane-Pardo, A.M.: Una revisión actualizada del concepto de eLearning. *Décimo Aniversario. Educ. Knowl. Soc.* **16**, 119–144 (2015)
15. Yoshida, H.: Perceived usefulness of “flipped learning” on instructional design for elementary and secondary education: with focus on pre-service teacher education. *Int. J. Inf. Educ. Technol.* **6**(6), 430–434 (2016)
16. Fidalgo Blanco, A., Sein-Echaluce Lacleta, M.L., García-Peñalvo, F.J., Pinilla-Martínez, J.: BRACO: Buscador de Recursos Académicos Colaborativos. En: *La Sociedad del Aprendizaje. Actas del III Congreso Internacional sobre Aprendizaje, Innovación y Competitividad. CINAIC 2015 (14–16 de Octubre de 2015, Madrid, España)*, pp. 469–474 (2015)
17. Sein-Echaluce, M.L., Fidalgo-Blanco, A., García-Peñalvo, F.J.: Students’ knowledge sharing to improve learning in engineering academic courses. *Int. J. Eng. Educ. (IJEE)* **32** (2), 1024–1035 (2016)
18. Séin-Echaluce, M.L., Fidalgo Blanco, Á., García-Peñalvo, F.J., Conde, M.Á.: A knowledge management system to classify social educational resources within a subject using teamwork techniques. In: Zaphiris, P., Ioannou, A. (eds.) *LCT 2015. LNCS*, vol. 9192, pp. 510–519. Springer, Heidelberg (2015)
19. Sein-Echaluce, M.L., Fidalgo-Blanco, A., García-Peñalvo, F.J.: Metodología de enseñanza inversa apoyada en b-learning y gestión del conocimiento. *La Sociedad del Aprendizaje. Actas del III Congreso Internacional sobre Aprendizaje, Innovación y Competitividad. CINAIC 2015 (14–16 de Octubre de 2015, Madrid, España)*, pp. 464–468 (2015)
20. Medina, J.: *Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School*. Pear Press, Edmonds, WA (2008)
21. Strayer, F.J.: How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learn. Environ. Res.* **15**, 171–193 (2012)
22. García-Peñalvo, F.J., Sein-Echaluce Lacleta, M.L., Fidalgo-Blanco, Á.: Educational innovation management. A case study at the University of Salamanca. In: Alves, G.R., Felgueiras, M.C. (eds.) *Proceedings of the Third International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM 2015)*, pp. 151–158. ACM, New York (2015)

23. Fidalgo-Blanco, A., Sein-Echaluce, M.L., García-Peñalvo, F.: Epistemological and ontological spirals: from individual experience in educational innovation to the organisational knowledge in the university sector. *Progr. Electron. Libr. Inf. Syst.* **49**(3), 266–288 (2015)
24. Lerís, D., Fidalgo, A., Sein-Echaluce, M.L.: A comprehensive training model of the teamwork competence. *Int. J. Learn. Intellect. Cap.* **11**(1), 1–19 (2014)
25. Fidalgo-Blanco, Á., Sein-Echaluce, M.L., García-Peñalvo, F.J., Conde, M.Á.: Using learning analytics to improve teamwork assessment. *Comput. Hum. Behav.* **47**, 149–156 (2015)
26. Sein-Echaluce, M.L., Fidalgo-Blanco, A., García-Peñalvo, F.J.: A repository of students' resources to improve the teamwork competence acquisition. In: ACM (eds.) TEEM 2015, Porto, Portugal, 07–09 October 2015, pp. 173–180. ACM, New York (2015). doi:<http://dx.doi.org/10.1145/2808580.2808607>
27. Sharples, M., Adams, A., Ferguson, R., Gaved, M., McAndrew, P., Rienties, B., Weller, M., Whitelock, D.: *Innovating Pedagogy 2014: Open University Innovation Report 3*. The Open University, Milton Keynes (2014). http://www.openuniversity.edu/sites/www.openuniversity.edu/files/The_Open_University_Innovating_Pedagogy_2014_0.pdf. Accessed 18 Feb 2016



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