Chapter 7
Crowdsourcing in Higher Education

Roberto Llorente and Maria Morant

Abstract Pervasive application of crowdsourcing techniques in Higher Education institutions improves the students' performance by using collaborative projects to enhance each student's skills, optimizes the lecturing process effectively sharing and pooling study materials, and also improves alumni financial situation by supporting tuition crowdfunding. In this chapter, we describe four key areas where the application of crowdsourcing techniques plays an important role in the performance of the alumni in Higher Education institutions. The proposed "crowdteaching" technique optimizes lecturing enabling sharing and exchanging of lecture notes following the different curricula of Higher Education studies. With "crowdlearning," the students learn by execution on collaborative projects where different students share (effectively teaching each other under lecturer supervision), learn the required skills required to carry out the targets of the project and solve the proposed problem. In relation to obtaining funding, with "crowdtuition" the students' tuition fees can be funded via crowdsourcing methods and also "crowdfunding" can be used to obtain laboratory and classroom material or students' learning stays abroad. Using these crowdsourcing methods, the students can find help to pay the university taxes and also interact with other students for a deeper learning process. Applying crowdsourcing to education enables the optimization of the institutions' budget and a more efficient use of time for learning which in the end leads to student's better results.

R. Llorente (✉) · M. Morant
Nanophotonics Technology Center, Universitat Politècnica de València,
Camino de Vera, Building 8F, 46022 Valencia, Valencia, Spain
e-mail: rllorent@dcom.upv.es

M. Morant
e-mail: mmorant@ntc.upv.es

F.J. Garrigos-Simon et al. (eds.), *Advances in Crowdsourcing*,
DOI 10.1007/978-3-319-18341-1_7

7.1 Introduction

A single individual cannot hold all available knowledge, not even a small group of people can. Superior knowledge is achieved when a large number minds are connected (i.e., networked), via ad hoc tools and methods. Colleges and universities can use crowdsourcing methods to enable superior knowledge building processes and to optimize lecturing and administrative processes, which ultimately permits an efficient use of time resources for high-quality teaching and a reduction of the alumni expenses, thus enabling more students to attend university (which is of great social benefit).

Crowdsourcing techniques can be a natural framework for learning although by itself it cannot offer the best educational experience. But applying the appropriate methods, it can offer improved education increasing the efficiency of workflows and optimizing the personalized curricula (Weld et al. 2012).

The introduction of crowdsourcing techniques in Higher Education (i.e., university and college), finds application in two key aspects that can dramatically improve alumni performance. On one hand, crowdsourced knowledge building opens up the possibility of collaborative projects where both the professors and the students can interact and exchange information. For instance, professors can share learning resources so a repository of high-quality materials can improve the quality of the lessons and save a lot of time in preparing the lectures. Also students' interaction in crowdlearning proposes to bring different skills to a common project to solve a given problem. And on the other hand, Crowdsourced Grant Schemes (or external crowdfunding) can be applied to student fees. Students with high ranks or excellent performance can take advantage of their skills by crowdfounding their tuition or obtaining funding for stays abroad.

These two applications require university-wide crowdsourcing software tools and platforms (Web-based, by example) which are reviewed in this chapter.

7.2 Crowdsourcing State of the Art

"Crowdsourcing" comes from the combination of words "crowd" and "outsourcing " and defines the distribution of a task among a group of people. Although the concept "crowdsourcing" first appeared in 2006 in Wired Magazine (Howe 2006), several events before that date contributed to the concept of "outsource work to a group of people." One of the most relevant and worldwide-known events was the creation of Wikipedia, a free-access and free-content Internet encyclopedia, launched in 2001 and that at present receive over 500 million visits every month. But several years before, in 1714, the British government offered a monetary prize (know nowadays as the Longitude Prize) to whomever came up with the best solution to measure a ship's longitude (Dawson and Bynghall 2012). This was the starting of crowdsourcing communities working together to solve a given problem.

In the nature of the concept, crowdsourcing does not require online resources, but the truth is that using the Internet makes crowdsourcing much easier and provides access to a wider amount of people around the world in less time and at a reduced cost.

The rise of crowdsourcing was possible thanks to the evolution of the Internet and of the social media technologies which enabled the communities to come together more quickly and to collaborate and exchange information (Isman et al. 2012). The idea of working in the same collaborative project with people located at the other side of the world would be unthinkable and require a huge cost if we could not use the Internet.

In recent years, crowdsourcing have been used in the market to perform a high variety of tasks that are difficult for computers, yet solvable, like in the case of Amazon Mechanical Turk (mturk.com). The ability to attract a crowd enables massive parallel processing which can lead to high throughput on tasks such as image labeling, audio transcription, and product categorization (Zhang et al. 2011). And with the growth of these online parallel solving platforms, crowdsourcing appears as a valid option available to anyone with a task or project in mind. Platforms like Wikipedia provide the clear evidence that coordinating a crowd for complex tasks is possible. Besides Wikipedia, there is a wide range of crowdsourcing community examples, especially in the field of language learning, as we will depict later in this chapter.

The concept of task parallelization based on simple partitioning and distribution of the process evolved to more sophisticated problem-solving procedures. With the correct coordination of the problem-solving crowd, it is possible to complete complex activities, e.g., programming tasks. For example, Little et al. (2009) developed a crowdsourcing platform called Turkit that enables the requesters to write programs executed by human workers on Mechanical Turk. In this case, the crowdsourcing strategy is based on dividing the proposed problem into small pieces that will be programmed by different workers. In fact, one of the main advantages of crowdsourcing is that it enables the possibility of iterative contributions of different people (Zhang et al. 2011).

One of the most common application scenarios of crowdsourcing platforms is gathering ideas about a given topic and vote on the most popular option. Crowdsourcing platforms can be implemented as an open and transparent site where everybody can access to the information and read and exchange opinions, but also the platform can include protection of the ideas where only authorized users can access to the information. In these cases, the proposed challenge is usually sponsored by an organization or industrial company which offers a prize to the best solution of the proposed task (Isman et al. 2012). Using this kind of competition platforms allows, especially for medium and small companies, to access to a wide range of ideas that would not be available in their usual environment or would require a considerable investment with the consulting a single or several external providers (Dawson and Bynghall 2012). For the industry, the main attraction for using a crowdsourcing competition platform is that, in most of the cases, this option is significantly less expensive than contracting a traditional company, e.g., a design agency to prepare a given product logo design or a marketing expert for the proposal of an advertising campaign.

In this chapter, we will overview the advantages of crowdsourcing applied to Higher Education activities.

7.3 Crowdsourcing Methods in Higher Education

Recent studies and first applications at colleges and universities have shown that applying crowdsourcing to education can be fruitful for both students and professors. Students would like to receive personalized education according to their abilities and learning style (Weld et al. 2012) and the recreation of the same lessons over and over is a waste of professors' time. With the proper use of crowdsourcing in Higher Education, professors can prepare high-quality lessons and provide useful instructions in class, and students are able to access to the best learning material and can improve their learning efficiency.

Evaluation techniques oriented to crowdsourcing have been used before in Higher Education at a smaller scale, for example peer-evaluation where the professor asks the students to evaluate each other's work. Early studies have pointed out that crowdsourced peer-grading can lead to more accurate assessments of the student's performance by combining different opinions with diverse perspectives and expertise (Page 2008).

In the last decade, with the emergence of Web technologies, online learning has evolved significantly using adaptive online environments that facilitate social learning (Corneli and Mikroyannidis 2012). For example, in the recent years, online tutoring systems have made considerable progress in Higher Education (Weld et al. 2012). There are four key areas where applied crowdsourcing techniques play an important role in the performance of the alumni in Higher Education institutions:

- Crowdteaching: In this approach, the lecturing staff share and put together lecturing material following the university curricula.
- Crowdlearning: This crowdsourcing technique is based on the "learning by project lecturing scheme." This scheme has been successfully applied in American and European universities. In the crowdlearning approach, the knowledge building process is based on collaborative projects where different students share, effectively teaching each other, and learn jointly the skills that are necessary to carry out the targets of the project.
- Crowdtuition: Crowdsourcing has an important impact for the social benefit. Crowdtuition techniques allow the best performing students' tuition fees to be funded via crowdsourcing methods. Different early experiences have been developed in the last years, including Universitat Politècnica de València (UPV) from Spain.
- Crowdfunding: Lecturing requirements in Higher Education, especially in Engineering Studies, require important investments in laboratory and classroom material. Whether classroom materials are usually funded by Government in the case of public institutions, laboratory inventory material is more difficult to be

obtained. Crowdfunding lecturing laboratories is an interesting technique that permits these laboratories to address specific techniques—to be lectured—for the social benefit, e.g., cancer research.

In this chapter, we describe in detail the different crowdsourcing methods that could be relevant to Higher Education institutions.

7.3.1 Crowdteaching and Educational Resources

One of the most common ways of using crowdsourcing in colleges and universities is sharing educational content. Professors seek for educational material with high-quality contents that could teach effectively the topics of a given curricula. But extreme attention should be paid in order to use trusted material, coming from sources with reputation behind it. This is also a problem that the students face when searching information in the Internet, as in some cases they rely in non-trusted sources which leads to misunderstanding and interferes with the learning objectives. In this scenario, UClass application (http://www.uclass.io) can be used as Common Core content repository, where university and college professors can share their resources with other professors in their same district. Using crowdsourcing planning, professors can access to the best curriculum across their district and drive higher student outcomes in their classroom. One of the main objectives of UClass repository is to exchange high-quality learning content with the aim to save professors' time in the preparation of their lessons. Also, UClass offers collaborative features for students to work together in different parts of the world.

In 2011, the Latin American Open Textbook Initiative was created with the main objective of dissemination of cooperative open textbooks aimed for Higher Education (customized per region) in order to avoid the high cost of textbooks in Latin America (Ochoa et al. 2011). This is an example, together with Wikibooks and Connexions platforms, between others, that have been found to reduce significantly (up to an 80 %) the cost of textbooks for the students.

7.3.2 Crowdlearning and Suitable Platforms

Crowdlearning appeared with the creation of educational platforms such as Skillshare (http://www.skillshare.com). Skillshare is an online learning community created to master real-world skills through project-based classes. So, "crowdlearning" can be defined as learning through real-case projects with the participation of several students ("crowd"). The advantage of this technique is based on each student to propose skills that already have—that can be useful to reach the final goal of the project—, in order to gather together different aptitudes.

When developing the project, the students share information and skills that automatically are learned when developing the project activities. It is important then to have a platform to effectively propose these skills that should match the competences established in the lecturing curricula. In this way, a categorization of competences should be implemented in the crowdlearning management tool.

After developing the project via crowdlearning, all students have shared their skills and competences, effectively learning other's competences.

Several online platforms are available for the creation of joint projects. Also, the crowdlearning platforms provide online courses that the students can follow at their own pace. Nowadays, it is clear that offering an online course can attract a crowd of hundreds of thousands students or even more. A clear example is Duolingo, a free science-based language education platform with over 38 million users. In only two years, Duolingo has become the most popular way to learn languages online and it was recently selected by TechCrunch as Best Education Startup and application of the year 2013 for iPhone and Android. According to an independent study conducted by the City University of New York and the University of South Carolina, an average of 34 h of Duolingo is equivalent to a full university semester of language education (Vesselinov and Grego 2012). Since one semester university course usually takes more than 34 h of work, this study suggests that Duolingo is more effective than an average university course.

Proper analysis can highlight the student tracking and detect confusion in given topics. For example, Coursera analyzes the student traces to determine which videos are watched again and also in what order, which helps optimizing the curriculum and the question routing. Nowadays, the curriculum design of online courses, e.g., Khan Academy, Coursera and Udacity, is normally centralized, but the great success of Wikipedia indicates that the action of a whole community can create incredible resources. For example, an increasing number of universities are offering nowadays, massive open online courses (MOOCs) dealing with topics requested by their students. Open educational resources (OER) had limited impact and attraction to the students in most of the cases due to the lack of coherence of the curriculum design (Mitros and Sun 2014). In contrast, MOOCs use a centralized approach where the institution (basically colleges and universities) designs a complete and more coherent course. Those courses are used in blended classrooms across many campuses. The main attractive of MOOCs is that typically they are taught by top professors and usually include research-based pedagogies such as active learning, constructive learning, and mastery-learning (Mitros et al. 2013). The centralization of the design and preparation of the MOOCs enables using more and higher quality resources per course than traditional courses. Previous studies suggest that well-designed MOOCs can lead to high-quality students' learning and high satisfaction levels (Lewin 2013).

In addition to these online learning platforms, YouTube's capacity to reach a different audience has made it one of the major media for innovative educational programming. Clear examples of this are the YouTube online channels "Crash

Course" and "SciShow" developed by Green brothers. Crash Course was one of the 100 initial channels of YouTube's $100 million original channel initiative. This initiative was a 100 million dollar program funded by Google to bring original content onto YouTube. The original channel initiative was also meant to kick start Google TV. For example, "Crash courses" is an educational YouTube channel for online teaching world history, biology, literature, ecology, and chemistry. As of December 2014, the "Crash Course" YouTube channel has earned over 2.4 million subscribers and over 160 million video views. The widespread acceptance of online educational videos has attracted the attention of television media contents. As a recent example, in November 2014, a partnership of Crash Courses with PBS Digital Studios was announced to expand the channel.

7.3.3 Crowdtuition

College tuitions increase the financial pressure on the students' families (Mitros and Sun 2014). The global economic turndown in the recent years has limited the number of alumni capable of fulfilling the tuition expenses. For instance in Spain, the university taxes were raised to 60 % in the last two years (Universia 2014) which made even more difficult for the students to access to a Higher Education study degree.

A crowdtuition program can be implemented by the university services, in which a loan is publically offered. The loan is intended to cover tuition expenses of a relevant pupil. This program is similar to the return-grant programs that are dedicated to guarantee that the knowledge and skills acquired at a university or institution are transferred back to that institution by recruiting alumni after finishing their PhD or after their postdoc research. This kind of return-grants is usual in Marie Curie postdoctoral programs and is also available in universities in Europe like by example the international center for genetic engineering and biotechnology of Italy (ICGEB 2014). But in this case what it is proposed in crowdtuition is that the tuition expenses of a given student are supported by an external company.

Crowdtuition proposes a social loan of brilliant students, which will return the loan after graduating when developing his career. These programs can support only brilliant alumni, as the loan was to be paid back after finishing the studies. This implies that a successful career is expected from the student when leaving the university once completed their Higher Education degree.

Early successful implementation of this approach was proposed in 2012 in the Universitat Politècnica de Valencia, Spain, where Comunitae.com offered 12,000 students the possibility of a student loan up to 2,000 euros with an 8 % interest at one year return (ABC 2012).

7.3.4 Crowdfunding Educational Infrastructures

A supplementary application of crowdsourcing can be also applied to raise funding to support a given cause. This concept is also known as "crowdfunding." Educational fund-raising is also possible and currently there are several online crowdsourced funding landscapes that provide educational support. The important investments required to purchase and update the material in laboratories and Higher Education classrooms can also take profit of crowdfunding. Usually, the Government covers the cost of the classroom materials of public institutions, but funding for the technical equipment or laboratory inventory material is more difficult to obtain. Crowdfunding lecturing laboratories is an interesting option that permits improving the research at Higher Education centers.

Crowdfunding can be also applied to support students' stays abroad. As student travel scholarships or educational travel grants are difficult to find, several crowdsourcing Web sites have appeared as a good option to seek for funding. An example of crowdfunding platforms is IndieGoGo where anyone over 13 years old can use the application and where, for instance, an educational summer abroad program is accepted for funding and also small donations that could help the student's travel.

7.4 Conclusion

This chapter provides a comprehensive approach to the advances that the application of crowdsourcing techniques can bring to universities and Higher Education institutions. Four key aspects are identified where crowdsourcing can play a key role: First "crowdteaching" is proposed to optimize lecturing by sharing and exchange of lecturing material. Crowdteaching requires ad hoc platforms supporting share and exchange of lecturing material following the different curricula of the Higher Education studies.

"Crowdlearning" is based on learning by execution principle developed in collaborative projects. Each student provides different skills that are needed to solve the proposed problem as a whole. The students share ideas and teach each other, which improves their preparation for their career.

By "crowdtuition," the students' tuition fees can be publically funded, which is an effective method for high–ranking alumni. Finally, "crowdfunding" is proposed to support laboratory and classroom material or students' expenses.

Applying the appropriate crowdsourcing techniques in Higher Education can increase the efficiency of the learning workflows and optimize the curricula which lead to student's better results.

References

ABC. (2012). Exalumnos de la UPV podrán financiar sus estudios a nuevos estudiantes. Available via ABC Spanish newspaper: http://www.abc.es/local-comunidad-valenciana/20121115/abci-exalumnos-podran-financiar-estudios-201211151410.html. Accessed December 5, 2014.

Corneli, J., & Mikroyannidis, A. (2012). Crowdsourcing education on the Web: A role-based analysis of online learning communities. In: Okada, A., Connolly, T. & Scott, P. (Eds.), *Collaborative learning 2.0: Open educational resources* (pp. 272–286). Hershey, PA: IGI Global.

Dawson, R., & Bynghall, S. (2012). Getting results from crowds. *Advanced Human Technologies*, 9–13.

Howe, J. (2006). The rise of crowdsourcing. WIRED magazine. Issue 14.06. http://archive.wired.com/wired/archive/14.06/crowds.html. Accessed December 5, 2014.

ICGEB. (2014). Education and training. Return grant. Available via http://www.icgeb.org/return-grant.html. Accessed December 5, 2014.

Isman, M., Bennet, J., Judah, J., & Glenzer, A. (2012). *Effectiveness and efficiency. Tapping new sources of innovations and ideas through crowdsourcing*. McLean: Booz Allen Gamilton Inc.

Lewin, T. (2013, April). Colleges adapt online courses to ease burden. *New York Times*.

Little, G., Chilton, L. B, Goldman, M., & Miller, R. C. (2009). Turkit: Tools for iterative tasks on mechanical turk. In *KDD-HCOMP'09*.

Mitros, P., & Sun, F. (2014). Creating educational resources at scale. In *2014 IEEE 14th International Conference on Advanced Learning Technologies* (pp. 16–18).

Mitros, P., Affidi, K., Sussman, G., Terman, C., White, J., Fischer, L., et al. (2013). Teaching electronic circuits online: Lessons from MITx's 6.002x on edX. In *2013 IEEE International Symposium on Circuits and Systems (ISCAS)* (pp 2763–2766).

Ochoa, X., Sprock, A. S., & Silveira, I. F. (2011). Collaborative open textbooks for Latin America—The LATIn project. In *2011 International Conference on Information Society (i-Society)* (pp. 398–403).

Page, S. (2008). The difference: How the power of diversity creates better groups, firms, schools, and societies. Princeton: Princeton University Press.

Universia. (2014). Las tasas universitarias suben un 60 % en dos años. España: emplea. Available via http://emplea.universia.es/detallecontenido/idnoticia/2253/c/candidato/. Accessed December 5, 2014.

Vesselinov, R., & Grego, J. (2012). *Duolingo effectiveness study*. Final Report. Available via http://static.duolingo.com/s3/DuolingoReport_Final.pdf. Accessed December 5, 2014.

Weld, D. S, Adar, E., Chilton, L., Hoffmann, R., Horvitz, E., Koch, M., et al. (2012). Personalized online education—A crowdsourcing challenge. In *Human computation*. AAAI Technical Report WS-12-08 (pp. 159–163).

Zhang, H., Horvitzy, E., Millerz, R. C., & Parkes, D. C. (2011). Crowdsourcing general computation. In: *CHI 2011*, May 7–12, 2011, Vancouver, BC, Canada.