2015

Experiments on Curricular Flexibility Performed in Higher Educational Institutions in the Network of Technological Education to Brazil

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Funder: Tu4D

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Abstract

This article presents two similar experiments on curricular flexibility, each of them performed in different Higher Educational Institutions in the network of technological education in Brazil. Both experiments aimed to allow better training routes, specially directed to the idea of the entrepreneurial university, applicable to enrolled students. On the other hand, it intended to reach better management of the Institutes resources. We used in both experiments the same curricular format, where all the subjects that made up a particular course had a workload of 40 hours and lasted only a month. Each month, new students could be enrolled in courses offered by the Institutes instantaneously, allowing ten periods of enrolment of students over a year, instead of only one, two or three. Students who left the Institutes for extended periods could then complete missing subjects, instead of missing them as it would occur in the traditional model. After the conclusion of these experiments, the students completed a survey questionnaire, comparing the traditional curriculum model and the model proposed in this experiment. The survey focused on the following areas: adequacy of time to follow the activities, retain and process the acquired knowledge; facility to interrupt the course; lower losses in case of interruption; adequacy of weekly hours for required frequency and time volume for the courses. For all these variables, this more flexible model was better evaluated by the students, especially to the categories related to course interruption and sufficient time to follow the activities. The students' answers showed that a more flexible curriculum met the expectations of most of them and was favourable to consolidate the Institutes role as entrepreneurial universities.

Keywords: Curricular flexibility; entrepreneurial university; instant classes

Introduction

Innovation is presented as one of the great contemporary issues, including the development of science and technology, and also its interfaces with society. In this context, technical and technological educational institutes have become the locus *par excellence* for features such as universality and connectivity. These institutions also awaken new expectation in society and can be perceived as central agencies for the affirmation of new paradigms. Moreover, they also represent the place in which the greatest challenges (especially social ones) are located. One of them is the ability to overcome the traditional barriers that strongly impact the access of disadvantaged social groups, which necessarily implies rethinking the social function of the institutes confronted with the identity of these groups.

Conceptually, innovation is moving away from the etymological sense that refers to the renewal, amendment, to something new, and its meaning is increasingly tied to its social utility. In this sense, for authors such as Lundvall (2007), innovation is actually defined as the invention that is successful on the market and is seen from a systemic perspective. However, in the field of education that term carries a quite unique semiotic set of meanings, especially considering two dimensions which are intrinsic to its core meaning: first, as a result of an organized action, which occurs in institutions, innovation regards the management and appears more as expressed in the Oslo Manual. It approaches thus the implementation of the idea of a new organizational process which, although related to the school archetype and therefore in a different arrangement from the most typical range of characteristics of the relationships that are established in a market order, it carries with it a significant field of possibilities. On the other hand, it brings the sense of the characteristics of educational actions which are related to its social function. In this sense, innovation in education relates to a broad thematic range, which includes everything from its propaedeutic dimension to the management of science/industry relations.

Roughly speaking, one can say that, in education, innovation can occur in three dimensions or places: the institution itself, the characteristics of this institution, as in its relationship with the industry and the market; in its teaching purpose; and, finally, in its methodological organization. To these places mentioned by Saviani (2012), we propose adding the management of innovation itself, often strongly linked to Information and Communication Technologies (ICTs). However, innovation made possible by the ICTs may be found transversely in many areas of the educational institutes, as in all of the above mentioned locations and thus also in planning and management education.

1. The federal Institutes as Entrepreneurial Institutions

The federal institutes of education, science and technology are institutions of higher, basic and professional education. Having multi curricular campi, they offer specialized, vocational and technological education under various methods of teaching, based on a combination of technical and technological knowledge to their teaching practices. The Federal Institutes make up the Federal Network of Professional Education, Science and Technology in Brazil.

The project for their creation was approved by the Brazilian Parliament and sanctioned by the President of the Republic on December 29, 2008, and published in the Federal Official Journal on December 30, 2008.[65] That means the Network is recent and have a long learning process ahead.

That can be seen as an advantage to the growth of the Network, as it is born with a new proposal and doesn't repeat the traditional model of the Brazilian Federal Universities. More than just one more educational network, Federal Institutes are created to be educational centers around applied research, innovation, entrepreneurship and interaction. Their goal is to

[65] Source: Official Page of the Brazilian Ministry of Education - http://redefederal.mec.gov.br/

stimulate the development of games, ideas, innovative products, processes and prototypes by students, together with their teachers and professors. With all these elements, the Federal Institutes are organized to work as entrepreneurial universities, according to the concept proposed by Etzkowitz (2004, 2008, 2010), related to the triple helix thinking (Etzkowitz & Leydesdorff, 2010), which describes a dynamic model of interaction between universities, Government and industry.

We perceive it is very important to understand, incorporate and disseminate the idea of the entrepreneurial university for establishing educational strategies and innovative management tools for dealing better with social issues and obstacles in technological education in Brazil. Some reasons can be listed on this account: the main sources of knowledge belonging to the Brazilian innovation system are universities and public scientific institutions; the main receivers of the proposed knowledge are students searching for vocational education and worried about being quickly absorbed in the work market; the generation of business that should be provoked by the network will most of the time require a dynamic work that keep students interested and allow them to complete the courses considering their working schedule or their personal social context. It's also important to consider that the model to be followed by the Federal Institutes should adapt to the fact that the generation of business that should be provoked by the network will most of the time involve firms R&D departments, which in turn will interact with these same universities and scientific institution, and require pragmatism and flexibility in the proposed schedule.

Capitalisation, Interdependence, Independence, Hybridisation and Reflexivity (CIIHR), which are the norms described by Etzkowitz (2010) for the entrepreneurial university model, can work as basis for management tools and educational models and lead the federal institutes to an optimum model of interaction highly favorable to technology transfer, innovation and generation of business.

2. Student dropout, social inequalities and public policy

Historically, dropout has become almost an intrinsic component of schools and universities. In contemporary and especially in unequal societies, like in Brazil, this issue has reached alarming levels. In an even more specific context described by technical education it presents disquieting results. Although technical and technological education possess specific characteristics, arising from general factors such as its acceptance in society, dropout also finds its rules in specific issues arising from guidelines issued by education systems. In this sense and as a way of forwarding the document *Public Policies for Professional Education and Technology* (BRAZIL, 2004) we suggest technical and technological education as an alternative path to social integration for young people who are faced with *restrictive mechanisms to access higher education* (p. 21).

One of the general principles of this document is to *commit to the reduction of social inequalities* (BRAZIL, 2004, p. 19). Since this is the first

principle mentioned and guides the other, one can consider it its central and primary goal. Therefore, these official document aims to equate social inequality not only from access to school, but also for its organization in terms of bureaucracy, time, space and curricula. The main objective shall be to avoid the so-called school failure revealed in practice in two ways: either the students drop out, or stay in school without reaching appropriate results to enable them to follow the sequential pace of school promotion.

Among the alternatives to solve it, one of the most important of them lies in the school organizational changes and concerns the flexibility in management, in order to ensure the principle of equal conditions for access and permanence in school, under the guideline of the Brazilian Act of Education, published in 1996. These guidelines include some aspects related to dropout, two of them deserving special attention: overcoming the semi-modular model that today is hegemonic and allowing recognition of the knowledge acquired under non-formal education. According to the Brazilian Act of Education:

> (Professional and technological education should) predict the organization of short, medium and long term courses in unfragmented modules, that should also be sequential and flexible. These modules should become plans of continuing education, which is structured in formative paths corresponding to different specialties, articulated to a certification system that favors mobility and professional development.

However, there are few studies concerning these possibilities and alternatives, especially towards the curriculum offer, and even fewer successful experiences.

3 – The offer of courses under the Federal Institutes System

Under the Brazilian law, the Federal Institutes must offer professional and technological training courses at all levels and modalities, as shown in Table I, having, therefore, the same autonomy given to universities. Its coverage should also be closely linked to technical and vocational training needs of the regions in which they are inserted. Furthermore, this purpose faces difficulties in legislation, which strongly regulates the different levels and types of formal education, especially on the technical and technological training of middle and senior levels.

The course at issue here, described as Initial and Continuing education, presents itself as a unique opportunity to experiment with alternatives for more flexibility in the organization of subjects supply, as the establishment of rules has referred to the autonomy of the Brazilian Federal Education and generally has no correspondence with the regular system of formal education. On the other hand, being offered at night and for the workers students, it presents the ideal basis for our analysis.

This system reinforces thus the backdrop to the present research: to know what effects, in the opinion of the students, the course offered through isolated subjects in concentrated time (Instant Class model) has compared to

the traditional system of biannual registration by set of subjects and curriculum components. Based on the results, the goal of our research is to evaluate the impact of the arrangement of possibilities experienced in these courses on dropout rates.

Table I – Levels and types of courses offered in the Federal Institute - Campus Taguatinga

Level/Mode	Hours/ Amount of Time	Course registration system	Requirements for graduation	Requirements for enrolling in the course	Certification
Higher Degree (teacher training)	Minimum 2.400	8 semesters/ the course is semiannual with enrollment by subject	Curriculum components + traineeship	Secondary school	Graduate diploma
Bachelor degree courses	Minimum 2.400	8 semesters/ the course is semiannual with enrollment by subject	Curriculum components + traineeship	Secondary school	Bachelor degree
Technological Higher Education Courses	Minimum 1.600	6 semesters/ the course is semiannual with enrollment by subject	Curriculum components + with or without traineeship	Secondary school	Diploma of Technology Course
Secondary school technicians Type: Integrated	Minimum 3.200. 2.400 hours correspond to high school education	3 to 4 years /Annual by group of subjects	Curriculum components + with or without traineeship	Basic education	High school diploma
Secondary school technicians Type: subsequent	800 a 1.200	3 to 4 semesters /semiannual by group of subjects	Curriculum components + with or without traineeship	High school	Technical High school diploma
Initial and Continuing Education (Free Courses)	**Varies with the course pedagogical project**	**Variable/group of subjects**	**Varies with the course pedagogical project**	**Varies with the course pedagogical project**	**Completion certificate**

3. Methodology

The possibilities are investigated using an innovative approach called instant class model, described in Santos (2008), which corresponds to the rearrangement of curriculum components of the Initial Training Course and Continuing Certification in Computer Networks, offered at the Federal Institute of Brasilia - Campus Taguatinga. The course focuses on skills related to Computer Networks and its goal is the preparation for certification exams offered by companies, which are requirements for access to the labour market.

Due to the characteristics of the course and the sample group, we organized the subjects supply per month, replacing the traditional model of subjects grouped in a six-month supply. During the second half of 2012 and the two semesters of 2013, every month a new subject was offered, always during the night shift, on Tuesdays and Thursdays and alternately on Fridays. Mondays, Wednesdays and alternate Fridays, which could contain other subjects, were not used in this experiment, although they have been used in Santos (2008). The full course provided an hourly-load of 200 hours. The curriculum is divided into six subjects of 33.33 hours. One of these subjects was prerequisite to all others and was offered six times during this period. All other subjects were offered once or twice and only students who were successful in the initial subject were included. This curricular organization reflects the experience of Santos (2008), although it was held originally in undergraduate courses in private institutions. The courses first experienced in the monthly model classes were: corporation networks, computer programs, accounting and economics.

For data collection, a survey type investigation was conducted, in which, according to the research objectives, we sought to identify the level of agreement or disagreement relative to the proposed categories, by using a mixed questionnaire with 15 questions in a five level Likert scale for the answers, ranging from "Strongly Agree" to "Disagree".

The categories were: enough time to monitor the activities; ability to retain and mature knowledge; facility for interrupting a subject; loss rate when a subject is interrupted; weekly frequency ratio required; and volume of subjects. The last question was not a variable analysis, but only a control alternative to analyze the reliability of the complete questionnaire.

Eleven questions referring to the socioeconomic characteristics of the students completed the instrument in order to group and relate the variables of monthly and semiannual models confronted with the economic reality of the respondents.

Data analysis was divided into three stages. At first, respondents were divided into two groups: those who attended more than one subject in the course, and those who attended only one subject. The separation of informants is justified by the quality of the possible answer, since the first group had more time to understand the advantages and disadvantages of the test model, in order to group and relate the variables of monthly and semiannual models confronted with the economic reality of the respondents.

The second stage of the analysis included descriptive statistics strategies, seeking to characterize the socioeconomic profile of the participants. After these procedures, the statistical tests were performed, using the difference test between averages for two related samples. The parametric test T-Student was applied for two paired samples and investigated the significance of the difference between the monthly and the semi-annual model average analysis in both groups.

The parametric test of paired averages comparison is used when the distribution is normal and when the averages are connected with each other (Levin, 1997). For the present study we used the 10% significance level for the tests.

4. Results and Discussion

4.1 Description of the Sample

The sample consisted of a group of thirty-five students. Of the respondents, six dropped out of the course, although they had attended more than one subject.

Below, Table 1 shows the general profile of students. Note that if the group of students who attended more than one subject has a lower average age than the ones in the other group. Also noteworthy is that in this same group more than 60% of the students work and over 50% have college degrees. The average family income of the group attended more than one subject is lower compared to the other group.

However only 35.75% of the group's respondents who attended only one subject work and their average age was above 30 years old. In addition, the majority of this group completed high school, which may represent that these respondents are used to the traditional school model and the contact with the monthly model was unsatisfactory or insufficient.

Table 1: Respondents Profile

Group	Average Income	Average Age	Gender		Work	Weekly Working Hours	Educational Level		
			Masc	Fem			Higher	Technical	Secondary
Attended more than one subject	2333,3	28	80,95%	19,05%	61,90%	22	52,38%	4,76%	42,86%
Attended only one subject	2857,2	34	78,57%	21,43%	35,71%	12	35,71%	-	64,29%

4.2 Average Test

The scale used for the answers was: 1 for “totally agree”, 2 to “partially agree”, 3 to “neither agree nor disagree”, 4 to “disagree” and 5 to “strongly disagree”. So the more the average is close to 1, more the students considered that characteristic as a positive one belonging to each model. Table 2 (below) shows the perceptions of students about the two models.

Table 2: Average score for each of the variables in relation to the analysis of the groups

Variables	Attended more than one subject		Attended one subject	
	Semiannual	Monthly	Semiannual	Monthly
Enough time to follow the activities	2,81	1,90	1,71	2,79
Enough time to retain knowledge	2,48	2,05	1,71	2,93
Enough time to mature knowledge	2,43	2,38	1,57	2,86
Facility for interruption or temporary absence	3,33	2,67	1,93	3,29
Lower loss when there is interruption or temporary absence	3,24	2,29	2,14	3,00
Required frequency rate	2,71	2,33	2,00	3,29
Volume of subjects by time period	2,57	2,19	2,07	3,57
General average of each model	2,80	2,26	1,88	3,10

Students in both groups had opposite perceptions. Respondents who had more time to understand the monthly model show in all axes they are more favorable to this model. The variables that showed a higher average difference between the two models were: “enough time to follow the activities”, “facility for interruption or temporary absence” and “lower loss when there is interruption or temporary absence”.

All the axes analyzed by the group that attended more than one subject were scored between “totally agree” (enough time to follow the activities) and “agree” (all others) when referring to the monthly model. However the category “facility for interruption or temporary absence” was assessed as “neither disagree nor agree” for the semiannual model. The other variables were scored as “agree” for the semiannual model.

On the other hand, the group that had less contact with the monthly model, as was demonstrated in the first results, consists mostly of people who do not work. This group understands the semiannual model as better compared to the monthly model. Thus the responses indicate that the monthly model, which allows greater flexibility in attending the subjects, affects most significantly the students that are already in the labor market.

This result is reinforced by the fact that the group of the students who attended the monthly model is in 61.90% already in the labor market. Thus the monthly model was perceived as more flexible since the variables related to interruption and absence were scored best in the monthly model compared to the semiannual model.

It is important to clarify that, although the group that attended only one subject has scored worse for the monthly model, the group didn’t totally disagree with the model advantages. The variables “enough time to follow the

activities", "enough time to retain and mature knowledge" were scored by the group as "agree". The other axis of the analysis were scored as "neither disagree nor agree". The scores of the variables also show that the group did not have enough time to understand the monthly model and better judge its characteristics.

Table 3 below presents the average test where the scores for each axis for the two models and the two groups are compared. Its aim was to find out if there is statistically an average difference at the 10% significance level between the responses of the two groups.

Table 3 shows that the averages of the answers for the two groups (monthly and semiannual) in almost all the axes was statistically different. However four variables didn't present significant difference: "Volume of subjects by time period – semiannual"; "Facility to interruption or temporary absence – monthly"; "Lower loss when there is interruption or temporary absence – monthly" and "Demanded frequency – semiannual".

Table 3: Average test comparing the groups for the two models

Variables	Difference Average	Minimum	Maximum	Sign. Calc.	Significant at the 10% sign. level
Time to follow the activities Semiannual	1,07	0,27	1,87	0,01	Significant
Time to follow the activities Semiannual and Monthly	-1,00	-1,78	-0,22	0,02	Significant
Time to retain knowledge - Semiannual	0,79	0,06	1,51	0,04	Significant
Time to retain knowledge monthly	-0,79	-1,64	0,07	0,07	Significant
Time to mature knowledge - semiannual	1,00	0,36	1,64	0,00	Significant
Time to mature knowledge - monthly	-0,57	-1,16	0,02	0,06	Significant
Facility to interruption or temporary absence - semiannual	1,71	0,82	2,60	0,00	Significant
Facility to interruption or temporary absence - monthly	-0,79	-1,88	0,30	0,14	Non significant
Menor perda quando há o trancamento ou ausência temporária Semestral	1,07	-0,14	2,28	0,08	Significant
Lower loss when there is interruption or temporary absence - monthly	-0,79	-2,11	0,54	0,22	Non significant
Demanded frequency - semiannual	0,57	-0,35	1,50	0,21	Non significant
Demanded frequency - monthly	-1,00	-1,93	-0,07	0,04	Significant
Volume of subjects by time period - semiannual	0,57	-0,24	1,38	0,15	Non significant
Volume of subjects by time period - monthly	-1,43	-2,10	-0,76	0,00	Significant
General average of the semianual model	0,86	0,22	1,49	0,01	Significant
General average of the monthly model	-0,86	-1,53	-0,18	0,02	Significant

The result of the average difference test confirms the different perceptions showed by the various profiles of students and the importance of having enough time to understand and absorb the monthly model. It is important to emphasize that the research was based on the fact that students had previous contact with the traditional school that divides subjects and evaluation and grading per semester.

5. Conclusions

The present study shows that the monthly model was perceived as more advantageous by the students who were already in the context of the labor market. Thus, it was noticed that it is appropriate and meets the expectations of a specific audience, which, otherwise, would not follow the content taught in a less flexible course schedule.

Therefore we conclude that the monthly model, as a proposed flexibilization of the educational process of the students, is an ally to fight dropout, since the students themselves are more likely to drop out of the course when there are difficulties about interrupting it or being temporarily absent. In this case, the students noticed that there is lower loss in a monthly schedule.

In addition to serving students prone to dropout, as highlighted by *Public Policy on Vocational and Technological Education* (BRAZIL, 2004), providing flexibility to the organization of vocational and technical education, by covering students with difficulties in finding time to attend school continuously, the whole sample presented positive results for the monthly model and showed it is an adequate alternative for these specific groups.

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