

Comparative analysis of effectiveness in Traditional and Online Education at the Aeronautics Logistic Institute

Análisis comparativo de las efectividades en las modalidades de Educación Presencial y Online del Instituto de Logística de Aeronáutica

Análise comparativa das efetividades nas modalidades de Educação Presencial e On-line do Instituto de Logística da Aeronáutica

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ABSTRACT

Online Education is a learning process where students and teachers use information and communication means and technologies, developing educational activities in different places or times. The present article is intended to identify the migration from traditional (in-person) education to Online Education, performed by ILA – Aeronautics Logistics Institute – between 2009 and 2013, in professional qualification provided to servants who act in aerospace logistics. Since professors' attitudes and performances, in addition to other factors, are the basis for each modality effectiveness, comparisons were made among the answers to the surveys submitted to ILA instructors and tutors, concerning didactic practices that are common to the educational modes. The result of such comparisons was used as tool to analyze the professional qualification provided by ILA in each modality in the period considered. By means of this study, the conclusion is that the Online Education showed learning effectiveness superior to that of traditional education, and has also presented advantages related to low global costs and low impact on students' productivity.

Keywords: Distance education. Online Education. Classroom education. Professional qualification.

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RESUMEN

La Educación Online se caracteriza por un proceso de aprendizaje en el cual estudiantes y los profesores utilizando los medios y tecnologías de información y comunicación, desarrollando actividades educativas em distintos lugares o tiempos. Así, este artículo tiene el objetivo de identificar los efectos de la migración de cursos presenciales para la Educación Online, realizada por el Instituto de Logística de la Aeronáutica (ILA) en el período de 2009 a 2013, en la capacitación profesional proporcionada a los servidores que actúan en logística aeroespacial. Como las actitudes y los desempeños de los docentes, además de otros factores, forman la base de la efectividad de cada modalidad, fueron realizadas comparaciones de las respuestas de las encuestas enviadas a los instructores y tutores del ILA acerca de las prácticas didácticas comunes a los modos educativos. El resultado de las comparaciones fue utilizado como herramienta para hacer deducciones sobre la capacitación profesional proporcionada por el ILA en cada modalidad, en el período considerado. Por medio de este estudio, se concluye que la Educación Online proporcionó efectividad de aprendizaje superior a la Presencial, además de las ventajas relativas a los más bajos costos globales y al más bajo impacto en la productividad de los alumnos.

Palabras-clave: Educación a distancia. Educación Online. Educación presencial. Capacitación profesional.

RESUMO

A Educação On-line é caracterizada por um processo de aprendizado no qual estudantes e professores utilizam meios e tecnologias de informação e comunicação, desenvolvendo atividades educativas em lugares ou tempos diversos. Assim, este artigo tem o objetivo de identificar os efeitos da migração de cursos presenciais para a Educação On-line, realizada pelo Instituto de Logística da Aeronáutica (ILA) no período de 2009 a 2013, na capacitação profissional proporcionada aos servidores que atuam na logística aeroespacial. Como as atitudes e os desempenhos dos docentes, além de outros fatores, formam a base da efetividade de cada modalidade, foram realizadas comparações das respostas das pesquisas submetidas aos instrutores e tutores do ILA acerca das práticas didáticas comuns aos modos educacionais. O resultado das comparações foi utilizado como ferramenta para inferir-se sobre a capacitação profissional proporcionada pelo ILA em cada modalidade, no período considerado. Por meio desse estudo, concluiu-se que a Educação On-line proporcionou efetividade de aprendizado superior à Presencial, além das vantagens relativas aos mais baixos custos globais e ao mais baixo impacto na produtividade dos alunos.

Palavras-chaves: Educação a distância. Educação On-line. Educação presencial. Capacitação profissional.

1 INTRODUCTION

The Aeronautics Logistics Institute (ILA) is the Aeronautics Command organization (COMAER) responsible for technical and managerial qualification of professionals who work in aerospace logistics (aircraft maintenance, supply of spare parts, transport, hiring, fire fighting in aerodromes, armament, and other activities associated to logistic support to air operations).

ILA offers classroom courses, blended courses and distance courses, in order to provide the required skills to each position and role in COMAER logistics area.

It is important to remark that the dichotomy between classroom education and distance education is something that tends to be reduced over time, through the increasing use of new Information and Communications Technology (ICT) in classroom mode, extending classroom interactions in virtual environments connected via Internet.

An outstanding fact concerning ILA educational activities is that professors do not belong to its staff. The most skilled and updated professionals of the Air

Force are trained by ILA to play the role of instructors in classroom disciplines and tutors in disciplines developed in the Virtual Learning Environment. That, in order to provide the student with the most updated knowledge and techniques of aerospace logistics.

At ILA, classroom courses follow the traditional learning method, with lectures, group work, individual assignments, written objective tests and, eventually, dissertations.

Some five years ago, COMAER intranet network, known as INTRAER, went through an increment in performance, reaching a data traffic speed that allowed the use of virtual learning environments. Since it is also known that, at the time, the demand for qualification was superior to ILA capacity, it was decided to migrate the most demanded courses to Distance Education (EAD) modality, using INTRAER network and the Internet.

Having worked in this Institute during this whole period, this study author has, many times, doubted both the validity of these migrations to other educational

modalities, and whether these migrations could have prejudiced ILA students qualification level.

In order to answer these doubts, the present research was performed, intended to identify the effects of the migration from classroom courses to online courses, occurred in the Aeronautics Logistics Institute (ILA) between 2009 and 2013, on the professional qualification provided to servants who act on Aerospace logistics.

The regulation of Distance Education (EAD), provided in the National Educational Bases and Guidelines Law (LDB), was established in Presidential Decree nº 5.622, of December 19, 2005 (BRASIL, 2005).

In its 1st Art., this decree defines EAD as follows:

Art. 1st For purposes of this Decree, distance education is characterized as educational modality where the pedagogic-didactic intermediation in learning and teaching processes occurs by the use of information and communications means and technologies, with students and teachers developing educational activities in different locations or times. (BRASIL, 2005, p.1, our emphasis).

The author of the present work highlights in Brasil (2005) quotation the expression “in different locations or times”, emphasizing that the decree has not use the word ‘distance’. It is a fact that the professor-tutor can

be present in teaching-learning process by means of interactions via Virtual Learning Environment or other communication or technological means, even being physically distant from the student.

The Aeronautics Command Instruction (ICA) 37-563 defines EAD as follows.

Teaching-learning process where apprentices are physically separated from the teacher, involving the use of specific technological means that permit this modality of teaching-learning and interactive communication. It applies both to formal and informal education, in all levels, and to human resources training and development. It uses tutorial methodology that provides autonomous learning of students, using specific organizational and administrative structures. (BRASIL, 2014, p. 31).

Almeida (2003) states that Online Education is performed via Internet to quickly distribute information, and in the use of provided interactivity, ensure interaction among people. In this context, the nomenclature that gets closer to ILA EAD practice and to that of other present teaching institutions is Online Education. This will be, therefore, the expression used in this work to refer to EAD as practiced in that Institute since 2009.

Chart 1 shows a comparison among Classroom and Online modalities characteristics, implemented by ILA.

Chart 1 - Aspects of ILA Classroom and Online Education modalities.

ASPECT	MODALITY	
	CLASSROOM	ONLINE
Pedagogic method	Instructionism ¹ .	Constructionism ² .
Location	Fixed: classroom.	Movable: depends on Internet access.
Time	Determined.	Preferential and flexible.
Classes' systematic	40 classrooms per week, each of them lasting 50 minutes.	10 or more online interaction moments per week, each of them lasting 60 seconds.
Professor	Explainer, center of knowledge and specialist.	Advisor and facilitator of learning.
Amount of students	Around 20.	Around 40.
Feedback to the student	In class, by gestures and oral communication.	Asynchronous via discussion forum, email, SMS or other communication tools.
Resources used	Oral speech, board and projector.	Computer, Internet, interactive resources (discussion forum, email, chat, collaborative writing, videoconference, etc.).
Didactic materials	Traditional bibliographic references and handouts.	Access to material through the online library services, hypertext, videos, podcasts and interactive PDF files ³ .
Assessment systematic	Objective written test and group work.	Online test, self-evaluation, individual work and participation in assessed discussion forum.

Source: The Author (2014), based on his experience in ILA qualification processes' management.

¹ Instructionism is based on the principle that the teaching action is strongly related to information transmission (instruction) to the student (VALENTE, 1993).

² Constructionism is based on the view of learning as an active attitude, since the student builds his own knowledge (VALENTE, 1993).

³ Interactive PDF files allow the reproduction of didactic videos and other animated instruction objects. Podcasts are short audio recordings prepared by the Tutor and made available to students through virtual learning environments.

Besides the student, another important player in the learning process is the Professor-tutor, also called Tutor. ICA 37-563/2014 defines Tutor as follows.

Professor specially trained to mediate learning in virtual environment. The Professor-tutor or simply Tutor is responsible for conducting the teaching-learning process, for encouraging students interaction in programmed activities, for explaining the doubts sent by students and for assessing the student performance in the Virtual Learning Environment. (BRASIL, 2014, p.12).

This research is relevant not just because it gathers knowledge on the effects of migration from classroom courses to Online Education on the level of professional qualification reached by militaries, but also for providing a balance between advantages and disadvantages of each educational modality, considering cost aspects (expenses with daily rates and tickets) and non productive aspects (distance from the organization of origin), inherent to each modality. Such knowledge will provide important information to decision making as to future migrations from classroom courses to Online Education or to develop blended courses, also known as bimodal or blended learning.

2 BIBLIOGRAPHIC REVIEW

One of the most well accepted definitions for Online Education is provided by Preti (1996), who distinguishes it from Classroom Education for being a technological system of bidirectional communication, that is, where the student participation is vital to the success of the process, considering the replacement of interpersonal relation in classroom with didactic resources and the use of specialized tutorship and new Information and Communications Technology (ICT) to obtain a more autonomous and flexible learning.

2.1 Advantages of the Online Education

According to Kokemuller (2004, our translation), the chief reason for opting for Online Education is associated to convenience, since, through it, school works can be made at home or at any other location with internet connection.

It is worth remarking that, nowadays, Classroom Education has also benefitted from the use of ICT, extending school activities to beyond the time table and providing more interaction, collaborative creation and flexibility.

Kokemuller (2004) has also stated that the possibility of making tasks according to one's own agenda and manage the learning rhythm are also attractive aspects of Online Education. Besides, virtual environment students can develop their technological and online collaboration skills while participating in discussion forums and other cognitive activities.

ILA educational process uses discussion forums intensively, which present the advantage of being asynchronous, providing more time for the preparation of interactive texts and minimizing communication failures.

With regard to COMAER students, another advantage concerns economy of resources for payment of accommodations and tickets, in addition to keeping the student at the seat, thus interfering the less in their routine, since, according to what is provided in TCA 37-563, in Brasil (2014), each chief shall allow their subordinate, enrolled in ILA course, two-hour dedication to study every day.

2.2 Disadvantages of Online Education at the seat

According to Kokemuller (2004), a key factor to the online learning effectiveness is that it requires a high level of self-discipline. Also important are time managing skills and the need of extra motivation.

With regard to the high level of discipline, time managing skills and the need of extra motivation, these attributes represent difficulties to be overcome by the online course student. Non-motivated or non-disciplined students will have difficulties to follow an online course.

Kokemuller (2004) has also stated that the limited interaction with tutors and the lack of face-to-face contact with other students limit interpersonal relations when compared to how they occur in classroom Education.

As to the limited interaction with tutors, the institution must train tutors in order to overcome this difficulty through intensive use of ICTs.

Another disadvantage of the Online Education is due to the dependence on Internet and INTRAER networks performance, and on the student skills in handling a computer.

2.3 Advantages of Classroom Education

Kokemuller (2004) has stated that the face-to-face class provides multisensorial experiences, once it makes possible hearing and noticing the instructor gesture,

as well as participating in practical activities and case studies. In it, interactions are immediate, since, in case the student wants to build and keep personal and professional relations during the course, classrooms offer this possibility of personal contact.

Leffa (2005) compares classroom interaction with virtual interaction, placing the effect of the latter as similar to that of the classroom.

The virtual interaction, which in fact is real, since we know that there is a real person on the other side exchanging messages with us, and should not be seen as a limited version of the face-to-face interaction, but rather as a another interaction option. It isn't even inferior, or superior; it's only different. It can be equally intense and involving in the creation of a learning community. (LEFFA, 2005, p. 12).

Thus, the author of this study understands that virtual interaction can also be used in classroom teaching as auxiliary resource, extending classroom interaction and favoring the participation of shier students.

2.4 Disadvantages of Classroom Education

Opposite to Online Education, in Classroom Education there is a rigid time table that limits flexibility and renders difficult extra class educational activities. Except for the recorded class, the classroom modality is not available for later viewing. Students who have difficulty in maintaining focus, are more susceptible to distractions that deviate them from the instructor explanations, with few possibility of reviewing concepts presented in classroom.

Under COMAER administration point of view, the disadvantages are also related to budget, due to costs with daily rates and tickets, and non-productive, due to the total retirement of the military from his roles.

2.5 Ausubel Meaningful Learning Theory

Santos (2013), while analyzing the instructional design of ILA Electric Metrology Course (CMEL), sought learning activities and objects, and interactive tasks that could evidence the principles contained in the model proposed by Moreira and Masini (1982), used while planning the pedagogical and operational development of disciplines consistent with Ausubel Meaningful Learning Theory.

Ausubel (1968) has explained that Meaningful Learning is the building of cognitive bridges

between what one already knows and the knowledge built in later phases. That is, in case the new knowledge is related to that already acquired; the interest in the subject is triggered, thus favoring the learning.

If I had to reduce the whole educational psychology to one single principle, I would say: the most important learning information is the one the student already knows. Find out what he knows and base your teaching on that. (AUSUBEL, 1968, p. vi).

Santos (2013) has observed in CMEL instructional elements several evidences of these theory principles. As these practices of instructional development are common in other ILA online courses, developed from 2009 to 2013, it can be concluded that such practices favor, significantly, the effectiveness of the Online Education provided by the Institute.

2.6 Importance of works assessed in ILA courses

In Online or Blended Education, we can identify forms of dialogue, autonomy, and student control over his own learning, his own development of reflexive thinking and not just mere understanding or memorization. This allows the performance of non-classroom assessment with enough safety by the professor. (BRAGANÇA, 2014, p. 3).

The works assessed in ILA courses can be exemplified by the Inspection, Follow-up and Control of Contracts Course (CFACC), totally conducted in virtual learning environment, where the Tutor proposes tasks based on facts, so that students make decisions and produce formal documents of decisions as if they were, in fact, inspecting the contract. In these tasks, the following characteristics are observed:

a) consistent with Ausubel (1968) Meaningful Learning Theory and seeking relevant context in the real world, the cases were extracted from real contracts, where the Tutor presented the general lines of the service to be carried out and the relations between the Contracting Party and the Contractor, in terms of rights and obligations to both parties;

b) also based on this theory, relevant tasks were provided. The analyses of these cases allowed students to act as Contract Inspector while advising the Expenses Orderer, in terms of decision making legality; and

c) according to the social-interactionist proposal, provided by Vygotsky (1984), opportunities to collaborative building of knowledge were sought.

Some more experienced students, timely instigated by the Tutor, have presented examples of problems similar to the case under study, as well as the way how these problems were solved, so that the other students could establish reasoning lines to find an alternate solution to the case under study.

2.7 Importance of Discussion Forums

According to this paper author experience in tutorship activity developed at ILA since 2008, discussion forums have promoted a type of social interaction that led to the expansion of knowledge through mutual collaboration of students, with new ideas that instigated reasoning and favored internalization of new knowledge; aligned with Social-interactionist Theory, as proposed by Vygotsky (1984).

2.8 Importance of feedback and communications channels

Herman and Banister (2007, our translation), from Bowling Green State University (www.bgsu.edu), in their paper where experiences of migration from a classroom course to an online modality are reported, while submitting surveys to the online course students in the middle and by the end of the semester, stated that 89% of the students have agreed with the statement “The tutor has provided constructive feedback regardless of their performance in the course”.

In the assertive “The tutor provided communication channels with students whenever doubts appeared”, 83% of the students have totally agreed. Based on these results, Herman and Banister (2007) have confirmed the acknowledgement by students that the feedback provided has helped them to remain focused and productive in their learning efforts.

2.9 Importance of didactic materials’ design

Herman and Banister (2007) stated that high quality didactic materials were vital for students to reach the educational goals. Selected texts, internet papers and other resources have challenged the students’ way of thinking and served as catalysts for discussions.

Herman and Banister (2007) have applied questionnaires to two groups, and, in the question “Are readings required in the course challenging and do they provide fundamentals to learning and to the other activities of the course?”, 94% answered positively.

While converting handouts used at ILA in face-to-face modality to online modality, the development team wrote them in colloquial language so as to facilitate understanding, since the student would be more subject to individual study. In addition to this rewriting of materials, searches of images associated to the texts were made in order to optimize the communication between the material and the student.

2.10 Importance of learning rhythm

Herman and Banister (2007) have stated that another decision concerning the course design which has influenced students success in the new online course is the establishment of study routines. Standards of weekly tasks and their respective assessments led students to develop self-regulatory rhythm practices. These habits allowed students to complete tasks regularly and consistently, and to progress steadily until the end of the course.

The expectations consistency allowed students to develop their rhythm of reading, discussions and tasks conclusion in a comfortable way. It was also observed that ILA online courses follow the routines standard as adopted by Herman and Banister (2007).

2.11 Considerations on costs

Concerning online courses, except for fixed costs of trainings performed by the development team, the variable costs are daily rates and tickets for tutors, because the models adopted by ILA presupposes the presence of a tutor in the facilities, with exclusive dedication to students, through interactions in the virtual learning environment, during two or three weeks, according to the discipline total hours.

As to classroom courses, costs are related to students and instructors daily rates and tickets, in addition to the lack of production of theses militaries for remaining away from their organizations.

Chart 2 shows the approximate calculation of the Maintenance Workers Updating Course (CAM) costs, in its classroom version (extinct) and in its online version, indicating that an online course costs around seven to ten times less to COMAER, considering the classroom group with twenty students and online group with forty students.

Chart 2 - Comparison of cost per student of CAM course.

Course	Duration	A	B	C	A+B+C	(A+B+C)/a
		Daily rates (d) with students (a) R\$ 177,00 ⁵	Daily rates (d) with instructors (i) R\$ 177,00	Daily rates (d) with tutors (t) 0	Total costs (R\$)	Cost per student (R\$)
CAM ⁴ Classroom	10 days (80 hours)	20a x 12,5d x R\$ 177,00 ⁵	2i x 5,5d x R\$ 177,00	0	46.197,00	2.309,85
CAM Online	10 weeks (100 hours)	0	0	5t x 12,5d x R\$ 177,00	11.062,50	276,56

Source: The author (2014).

It is worthy of notice that the calculations presented in Chart 2 do not contemplate the costs of non-production of classroom courses students, which would certainly increase the differences between these courses.

3 METHODOLOGY

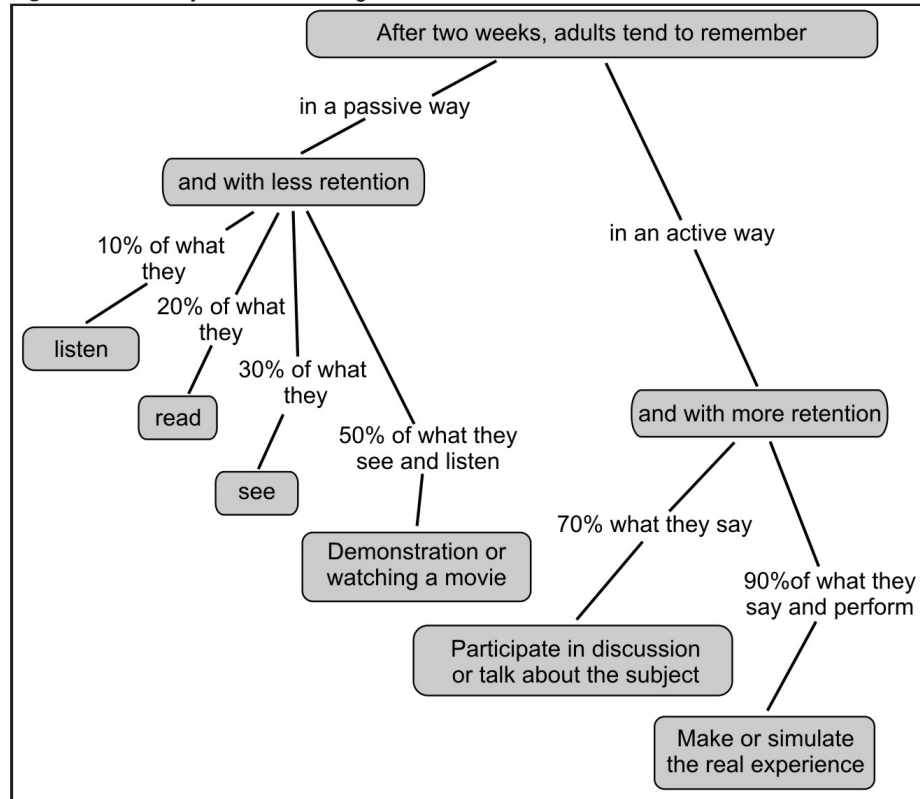
As research limitation, an ideal situation would be the existence of data to indicate performance and behavior changes of ILA former students, both after classroom courses conclusion and after online courses conclusion, so that these performances could be compared. Since these data are not

available, the option was the surveys with instructors and tutors on the use of the best didactic techniques, applicable to both educational modalities, and thus, consider the quality of training provided by these professionals in the period considered.

3.1 Subsidies for survey preparation

In order to prepare the survey with ILA professors, theories were researched that pointed to the most significant aspects of the teaching-learning process efficacy, arising as relevant option Dale’s Pyramid of Learning (DALE, 1969).

Figure 1 - Dale’s Pyramid of Learning.



Source: The author (2014), adapted from Dale (1969).

⁴ CAM - Maintenance Worker Updating Course.

⁵ R\$ 177,00 – legal value of daily rates for militaries in Guarulhos city – SP, where ILA is located.

Dale's Pyramid of Learning (DALE, 1969) has been used to demonstrate percentages and indices of information retention in different learning situations. Figure 1 presents one adaptation of this pyramid used as important subsidy to prepare the questionnaires applied to teachers.

Each question of the questionnaires received weight from 0 to 10, to allow the calculation of weighted arithmetic mean. This weight, associated to the mode, allowed the differentiation of instructors and tutors opinions.

Descriptions of weights assigned to questions options:

a) two questions were divided into ten options with 10% intervals, the question relative to interaction with the group percentages and that of involvement with group works;

b) eleven questions received the following options: "never" (weight 0), "rarely" (weight 1), "sometimes" (weight 3), "frequently" (weight 8) and "always" (weight 10);

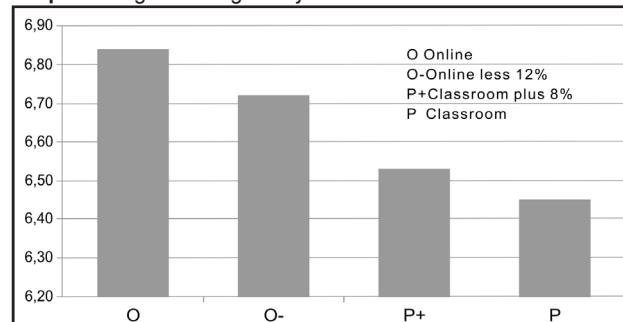
c) three questions received the following options: "I totally disagree" (weight 0), "I disagree in most cases" (weight 2), "I disagree" (weight 4), "I agree" (weight 6), "I agree in most cases" (weight 8), "I totally agree" (weight 10) and "I'm not prepared to give my opinion" (weight 0). Weights according to Likert scale.

4 ANALYSES OF DATA

Among the 198 questionnaires sent to instructors, 53 were answered. Among the 84 questionnaires sent to tutors, 25 were answered. The amount of questionnaires answered against those sent (the universal set) resulted in sampling errors of 8% for instructors answers and 12% for tutors answers. While comparing the answers to each question, it was possible to infer the Classroom and Online Educations modalities effectiveness, practiced by ILA in the period considered.

With regards to Graph 1, the O column represents the mean assigned to Online Education, the O- column represents this same degree minus 12%, which is the sampling errors to these answers. Column P represents the mean assigned to Classroom Education. Column P+ represents this mean plus 8%, which is the sampling errors to these answers.

Graph 1 - Degrees assigned by teachers to educational modalities.



Source: The Author (2014), based on results of survey with teachers.

Thus, considering that the general mean of instructors answers was 6.45 and the general mean of tutors answers was 6.84, Graph 1 shows that the score obtained by Online Education minus the sampling error of 12% is higher than the score obtained by Classroom Education plus 8% of sampling errors, which evidences the global advantage to Online Education, without considering costs reductions and low impact on students productivity, which constitute additional advantages. That has conduct to reasoning that the effect of migration from classroom courses to Online Education modality was beneficial to the level of qualification provided by ILA in the period considered.

4.1 Results of the survey questions

4.1.1 Percentage of the group that interacted among themselves and with the teacher

The Social Interactionist Theory, by Vygotsky (1984), values the interaction as an important means to build knowledge. So, with the difference between Classroom Education (6.07) and Online Education (5.48) superior to the sum of sampling errors, one can consider that instructors have observed higher levels of interaction in their classroom groups that tutors in their virtual groups.

4.1.2 Percentage of the group that have really involved in groups works

In this aspect, the mean of instructors answers 5.94, while the mean of tutors' answers was 4.78. Since the difference is superior to the sum of sampling errors, this evidences the advantage observed in Classroom Education regarding students involvement in group works.

4.1.3 Facilitation of handouts design in learning

Herman and Banister (2007) have stated that high quality didactic materials are essential for students to reach educational goals. So, in this aspect, Classroom Education has obtained mean of 6.81 (higher frequency of “agree” and “agree in most cases” answers), against 8.09 (higher frequency of “agree in most cases”) in Online Education. Since the difference is superior to the sum of sampling errors, we conclude that Online Education was remarkable regarding handouts instructional design.

4.1.4 The valorization of pedagogic practices in students ideas, seen as the chief participants in the learning process

In this case, with 7.81 mean for Classroom Education and 7.74 for Online Education, with difference inferior to the sum of sampling errors, and since both surveys have presented the option “agree in most cases”, we can conclude that both instructors and tutors value equally students as chief elements in the learning process.

4.1.5 Teachers attitude

With regard to the answers to questions intended to investigate teachers attitudes before their groups, see next their analyses:

a) Group guidance for discussions focus: Classroom Education has obtained 4.48 mean (answers with “rarely” option), against 6.04 (answers with “frequently” option) of Online Education. Since the difference is superior to the sum of sampling errors, it is evidenced the advantage of the Online Education regarding students maintenance in the discussion focus.

b) Encouragement of shier students: since the difference between Classroom Education score (5.91) and Online Education (6.70) is superior to the sum of sampling errors, it is considered that tutors value more than instructors the encouragement of shier students, which evidences the advantage for Online Education is this particular.

c) Proposal of complementary exercises: since the difference between Classroom Education (4.74) and Online Education (4.91) is inferior to the sum of sampling errors, it was observed the instructors and tutors consider complementary exercises as equally important.

d) Offer of individual feedback: Herman and Banister (2007) have confirmed, in their research, the acknowledgement by students that the feedback

provided by tutors has helped them to remain attentive and productive in their learning efforts. Since Classroom Education has obtained 4.50 mean, and Online Education, 6.83 mean, in “frequently” option, and since the difference is larger than the sum of sampling errors, this result confirms what was observed in Herman and Banister (2007) work, that is, the Online Education advantage in individual feedback.

e) Offer to clear doubts: since the difference between Classroom Education (9.26) and Online Education (9.30) is inferior to the sum of sampling errors, it can be considered that instructors and tutors find it equally important to offer themselves to clear students’ doubts.

f) Posture of learning intermediate: since the difference between Classroom Education (8.44) and Online Education (8.09) is superior to the sum of sampling errors, it can be considered that instructors consider more important the posture of intermediate between student and knowledge than tutors, which evidences advantage to Classroom Education in this aspect.

g) Guidance to debates, in person or through technology: since Classroom Education has obtained 4.89 mean and Online Education, 6.87. (with option “frequently”), and since the difference is superior to the sum of sampling errors, the latter has obtained special highlight with regard to the importance of guidance in debates by the tutor, which evidences advantage to Online Education in this aspect.

h) Interfered in a timely manner to redirect the learning: since the difference between Classroom Education (6.70) and Online Education (7.22) is superior to the sum of sampling errors, it can be considered that instructors consider more important the attitude of carrying out formative assessments in order to redirect, timely, the learning, which evidences advantage to Online Education in this aspect.

i) Assistance to students in technological problems solving: since Classroom Education has obtained 5.19 mean, and Online Education, 5.43, and since the difference is equivalent to the sum of sampling errors, the conclusion is that instructors and tutors value this aspect equally.

j) Encouragement of critical reflection: Ausubel (1968) states that, in case new knowledge is associated to that already internalized, this will cause interest in the subject, since it is meaningful, because favors learning. So, since the difference between Classroom Education (7.11) and Online Education (7.17) in this aspect, is inferior to the sum of sampling errors, it

can be considered that instructors and tutors value this aspect equally.

k) Encouragement of disciplines contents updating: since Classroom Education has obtained 7.69 and Online Education 7.65, and since the difference is inferior to the sum of sampling errors, it can be considered that instructors and tutors have assigned equal importance to disciplines contents updating.

l) Encouragement of communication and cooperation among students: since the difference between Classroom Education (7.67) and Online Education (7.13) is superior to the sum of sampling errors, it can be considered that, differently from tutors, instructors consider more important the attitude of encouraging communication and cooperation among students, which evidences advantage to Classroom Education in this aspect.

4.2 Synthesis of chief results

The research results have shown the superiority of Online Education as practiced at ILA, with regard to: (1) maintenance of focus in discussions, (2) encouragement of shier students, (3) individual feedback, (4) guidance in directed discussions, (5) didactic material design and (6) formative assessment.

Results have evidenced the superiority of Classroom Education in (1) interaction between students and with the teacher, (2) involvement of students in group work; (3) teacher role as learning mediator and (4) communication and collaboration.

In the other aspects, these educational modalities were considered equally effective, because the options chosen by respondents were coincident and differences between scores were inferior to the sum of sampling errors.

Among the sixteen aspects analyzed, in six, Online Education has obtained advantage, while in other aspects, the highlight goes to Classroom Education. Thus, in general, there was advantage to Online Education, with this being considered more effective in ILA students learning.

4.3 Implications of the research results to COMAER

The contribution of knowledge from this research is based on:

- Conclusion that Online Education was more

effective than Classroom Education as to aerospace logistics professionals;

- Gathering of knowledge on advantages and disadvantages of the migration from education modality and its effects on professional qualification provided; and

- Consideration on costs aspects (expenses with daily rates and tickets) and non-productive aspects (staying away from organization of origin), inherent to each educational modality.

This knowledge will form the basis for future decisions on migration or not from classroom courses to Online or Bimodal modalities.

5 CONCLUSION

This work presented the result of the study about the effects of migration from classroom courses to Online Education by Aeronautics Logistics Institute (ILA) from 2009 to 2013. The study provided knowledge on these educational modalities specificities and the result of the comparison between attitudes and didactic performance of instructors and tutors, and such knowledge is used as inference foundation on professional qualification effectiveness as provided to students who act in Aeronautics Command logistic systems.

This comparison was carried out through surveys submitted to ILA instructors and tutors on common didactic practices, and the results showed Online Education superiority as practiced at ILA, according to results obtained.

So the conclusion is that classroom courses migration to Online Education has improved the professional qualification level as provided by the Aeronautics Logistics Institute (ILA) from 2009 to 2013, as well as cost-effectiveness relation, though both educational modalities contribute to extend professional qualification opportunities in teaching organizations of COMAER.

Based on this result and on the analysis of advantages and disadvantages of each educational modality, it is recommended to institutions to dedicate efforts in order to include Classroom Education and Online Education in the same professional qualification project, as in bimodal courses, and not as isolated educational strategies competing among themselves.

REFERENCES

ALMEIDA, M. E. B. Educação a distância na internet: abordagens e contribuições dos ambientes digitais de aprendizagem. **Educação e pesquisa**. São Paulo, v. 29, n. 2, p. 327-340, 2003. ISSN 1517-9702.

AUSUBEL, D. P. **Educational psychology: a cognitive view**. New York: Holt Rinehart and Winston, 1968.

BRAGANÇA, R. C. M. **A avaliação em educação a distância**. Disponível em: <pigead.lanteuff.org/mod/resource/view.php?id=255>. Acesso em: 14 mar. 2014.

BRASIL. Comando da Aeronáutica. Comando-Geral de Apoio. Portaria COMGAP nº 234/1EM, de 03 de novembro de 2014. Sistema de capacitação do pessoal da logística (ICA 37-563). **Boletim do Comando da Aeronáutica**, Rio de Janeiro, 2015.

_____. Decreto nº 5622, de 19 de dezembro de 2005. Regulamenta o art. 80 da Lei no 9.394, de 20 de dezembro de 1996, que estabelece as diretrizes e bases da educação nacional. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 2005.

DALE, E. **3rd edition of audio-visual methods in teaching**. New York: Dryden, 1969.

HERMAN, T.; BANISTER, S. Face-to-face versus online coursework: a comparison of costs and learning outcomes. **Contemporary issues in technology and teacher education**, 7(4), p. 318- 326, 2007.

KOKEMULLER, N. **Online learning vs. classroom learning**. Disponível em: <everydaylife.globalpost.

com/online-learning-vs-classroom-learning-4190.html>. Acesso em: 27 mar. 2014.

LEFFA, V. J. Interação virtual versus interação face a face: o jogo de presenças e ausências. In: CONGRESSO INTERNACIONAL DE LINGUAGEM E INTERAÇÃO, 2005, São Leopoldo. **Trabalhos apresentados no Congresso Internacional de Linguagem e Interação**. São Leopoldo: Unisinos, 2005.

MOREIRA, M. A.; MASINI, E. F. S. **Aprendizagem significativa: a teoria de David Ausubel**. São Paulo: Moraes, 1982.

PRETI, O. **Educação a distância: inícios e indícios de um percurso**. NEAD/IE. Cuiabá: UFMT, 1996. 188p.

SANTOS, C. H. **A sistemática de planejamento de cursos na modalidade EAD on-line aliada à construção da aprendizagem significativa**. Artigo Científico (Curso de Aperfeiçoamento de Oficiais da Aeronáutica)-Escola de Aperfeiçoamento de Oficiais da Aeronáutica, Universidade da Força Aérea, Rio de Janeiro, 2013.

VALENTE, J. A. Diferentes usos do computador na educação. In:_____. **Computadores e conhecimento: repensando a educação**. Campinas: Editora da UNICAMP, 1993.

VIEGA, S. **Como utilizar a escala de Likert em análise estatística**. Disponível em: <educacao.umcomo.com.br/articulo/como-utilizar-a-escala-de-likert-em-analise-estatistica-402.html> Acesso em: 01 maio 2014.

VYGOTSKY, L.S. **Formação social da mente**. São Paulo: Martins Fontes, 1984.