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Holistic approach to higher education and artificial intelligence. Social implications

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Abstract: Artificial intelligence can make an important contribution to improving the quality of teaching, particularly with reference to approaches of holistic type. The complexity of teaching requires approaches to improvement which consider the complex relationships between the elements which compose it (subjects, processes, means), over the time and in the context in which it is realized. The purpose of the work is to present the reasons that led to the conversion of an innovative holistic approach to higher education (L'Acolto) in algorithms for artificial intelligence. In this sense, the work attempts to highlight how artificial intelligence can make an important contribution to the continuous improvement of teaching quality, with a holistic approach to higher education. In this sense it is highlighted the impact that this produces on a specific reference context and on the broader social context.

Keywords: Artificial Intelligence, Holistic Approach, Teaching Quality, Higher Education.

Introduction

In a social, cultural and economic context, in which artificial intelligence plays a growing role (Kaplan, 2016), the paper attempts to reflect on the opportunities arising from the use of artificial intelligence – AI, as a support to holistic approaches to continuous improvement of teaching quality, in higher education. In particular,

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the work focuses attention on an innovative holistic approach L'Ascolto (Verna, 2017¹; Verna et al, to be published) aimed precisely at the continuous improvement of teaching quality. The need for a holistic approach to higher education emerges in the literature (Sakthivel & Raju, 2006) and there are numerous studies that address these issues (Horine & Hailey, 1995; Burkhalter, 1996; Barnard, 1999). The holistic approach on which L'Ascolto is based is a response to the complexity of teaching (Casey, Gentile, Bigger, 1997). To improve the quality of a complex system it is necessary to act on the whole and on the relations that regulate such a system and not on individual parts of it (Mantos et al, 2017). Ultimately, L'Ascolto acts, on the variability of the teaching system, as a "regulator" of the interdependencies among the elements which compose it. In particular, the reference is to the subjects who, at various levels, work in education and teaching (teachers, students, institutional bodies, stakeholders), to the needs they express, to the relations which bind them, in the context of time and space in which they operate. It is clear that all this involves a complex system of management and sharing of information deriving from these relations and interdependencies. In this sense, the A.I. allows to overcome numerous obstacles deriving from the comparison with complex systems such as didactics (Casey, Gentile, Bigger, 1997). Just to make an example, the management and interpretation of complex, continuous and consistent information flows, the timely selection and sharing of these information flows to support decisions for teaching quality improvement. Furthermore, A.I. allows the elaboration and management of the knowledge deriving from the teaching and training processes, selecting and sharing the best practices among teachers of the same context (specific or extended) for the professional development of teachers and students. In particular, A.I. neither replace the teacher in his/her didactic autonomy nor diminishes his/her professionalism or creativity, but it offers specific information for his/her operational context, enhancing an otherwise unexpressed professionalism. Furthermore A.I. by reproducing a holistic approach to higher education, does not offer

¹ A Public act filed with a notary of the Italian Republic, 2017.

information limited to single aspects of teaching and training, but system information that aspires to system results. The aim is to “regulate” the variability of a complex system like higher education in order to satisfy the education and training needs of all those involved in teaching for a cultural revolution able to involve the social context. In this sense the work is divided into two parts. In the first one, it is presented, with respect to the reference literature, L’Ascolto approach is presented in its peculiarities and within the limits that this presents in the absence of A.I. supporting tools. The second part examines the reasons and the advantages that led to the translation of this approach into algorithms for A.I. (Verna, 2017).

Holistic approach to higher education: L’Ascolto. Specific features and advantages

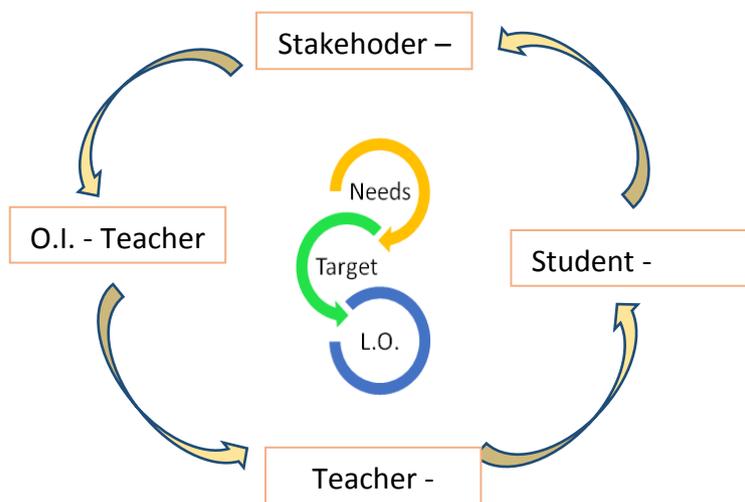
L’Ascolto is based on the TQM logic (Feingebbaum, 1956; Juran, 1962; Deming 1951) and is aimed at listening to and satisfying the needs of all those involved in education teaching and training (clients)². L’Ascolto, as mentioned above, is an attempt to respond to the complexity of teaching which manifests itself in terms of the time, in which teaching takes place (Barone & Lo Franco, 2009; Verna, 2008, 2010, 2012; Chen et al, 2014), of a relational, disciplinary, social, cultural context of reference (Lawn, 1991, Carptner B., Tait, 2001). In this sense, fig.1 below, shows how listening to customers' needs is realized, in the L’Ascolto approach. In particular, it highlights how the listening to the needs of students (Zineldin et al, 2011), is linked to the listening of teachers (Rosa, Tavers, & Amarl, 2006), of employers (Willis & Taylor, 1999; Rodman et al., 2013) and institutional bodies, as parts of a complex system (the higher education system). There is a clear need for a plurality of information sources (listening) to capture the complexity of teaching (D. Hoyt, W. Pallet, 1999). In particular, the figure shows how listening is focused on the relations and interdependencies among customers and on the “information” that

² We do not want to enter the debate on the concept of customer by referring to the existing literature (Becket & Brookes, 2006).

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derives from them. This information is collected and processed in terms of: needs (listening), target (declination of these needs in target) and learning outcomes - L.O. (assessment of the level of satisfaction of the needs). This listening to needs is perpetuated in the time in which the teaching and training is carried out, outlining, in this sense, a specific context (needs, target, L.O.) and a broader one (i.e. disciplinary, social, cultural).

Fig.1 L'Ascolto, Listening of the needs: specific context



In particular, in a specific context, stakeholders need Courses of Study – CoS that express professional profiles in line with market needs. At the same time, stakeholders need to see an actual correspondence between what was declared in the CoS and the skills acquired by the students.

The institutional bodies – IB (e.g. Athenaeum, department, etc.) need approaches capable of listening to stakeholders' needs and translating them into an appropriate educational teaching and training plan (CoS) (Bloom's taxonomy, Bloom et al 1956). At the same time, these bodies need to ensure, for the provided education a quality corresponding to what promised in the CoS. In this sense, the

IB need to be able to manage in a systematic, structured and continuous manner over time a wealth of knowledge and skills deriving from the implemented educational processes. On the other hand, students need CoS that offer competitive educational courses, in line with the needs of the market and that their achieved educational levels reflect what declared in their CoS.

In this context of different needs also teachers' ones emerge. In particular, teachers need an information support for systemic listening to needs emerging from their context (students' needs in relation to those of stakeholders and institutional bodies) and for satisfying them. With respect to this, it emerges the teacher's need of a tool to "support/guide" the processes of planning, management, evaluation of training, capable of directing the teacher to the improvement and innovation of the educational processes without limiting their didactic autonomy. In particular, the educational and training needs of teachers are listened to through tools (teacher self-assessment and student satisfaction tests) that monitor the "key processes" of teaching quality, in a specific context. In literature we refer to the teaching quality building blocks (Probst et al., 2002; Ramsden, 2003) that some authors have organized into ten constellations (Chen et al, 2014).

Furthermore, teachers need to be able to share best practices of colleagues who work in their same context (needs, target and learning outcomes). This is linked to the need for a disciplinary coordination among colleagues belonging to the same CoS. Ultimately each teacher needs to continuously manage and share a system of knowledge and skills, fueled by the teaching and training processes s/he implements in terms of design, management, evaluation and improvement. This system of management and sharing of knowledge could satisfy a further teachers' need, that of continuous training/self-training. A need which extends itself also to the possibility of using this knowledge (deriving from the experimentation of a holistic approach to higher education) for the development of scientific research in the education and training field. But such a "specific context" generates a cultural revolution of an "extended context", the social one.

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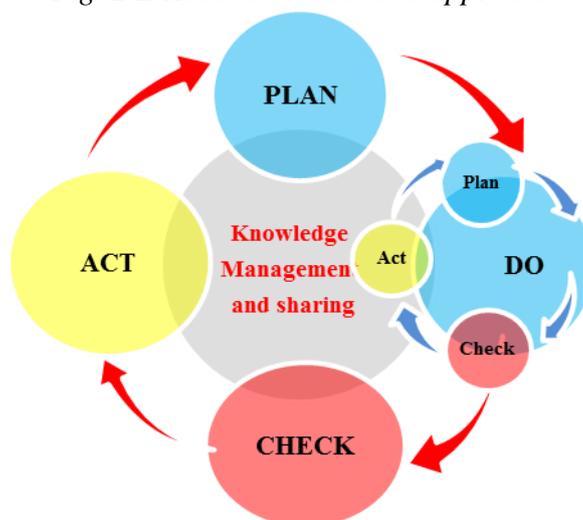
The holistic approach of L'Ascolto starts from the consideration of the context of clients and their needs as a single whole, in which relations and mutual influences represent the appropriate perspective of listening to the needs themselves. In this perspective, satisfying needs means satisfying a system of relations and interdependencies and not "simple customers". That is, to satisfy the needs of the stakeholders, I have to listen to their needs and translate them into targets, (Bier & Cornesky, 2001) putting them in relation to the listening to the training needs of the students (gap between expected educational level and the actual one: L.O. as input).

The satisfaction of the students' needs depends on the fulfilment of the educational needs (continuous education and training and self-education and training) that the teachers express with respect to the ability to reduce that gap. In this sense, satisfying the needs of institutional bodies means satisfying a system of relations and interdependencies between the customers and their needs, between the means and processes at their disposal to satisfy these needs. The quality of higher education can therefore be defined as a "system result" that passes through the quality of the relations which bind the elements that compose it. The quality of higher education, therefore, is not the algebraic sum of the satisfactions of individual needs, rather than the result of a "regulation" of the interdependencies among the variables of a complex system (Verna, 2006), that is what could be defined as a "superior quality" capable of contaminating the whole context in which it acts (specific and extended).

In particular, L'Ascolto applies the PDCA of Deming – Plan, Do, Check, Act (Deming, 1951) integrated into the Quality Function Deployment – QFD (Akao Y, 1990) for the standardization of information gathering, selection and management processes deriving from listening to the needs (QFD) and for the satisfaction of the same in the continuous processes of planning, management, evaluation and improvement of the quality of teaching (CoS and single courses). In this context, the PDCA nurtures a system of management and sharing of knowledge which links the listening to the needs of all customers, to the knowledge of fundamental processes, of how they are structured and of the relations which bind

them – for the full satisfaction of needs of all customers in their mutual influences. Fig. 2 (Verna et al, to be published) shows in a schematic form how the aspects of the teaching complexity are faced by a holistic approach. The question that can be asked at this point is therefore the following: how is it possible to implement this approach effectively and efficiently, so that the result achieved is actually a system result that contaminates an enlarged context? In the following paragraph we try to answer this question highlighting the critical aspects of the L'Ascolto approach that led to the development of an algorithm for the A.I. (Verna, 2017).

Fig. 2 L'Ascolto: the holistic approach



Applicative limitations of the holistic approach: listening and the contribution of artificial intelligence.

A difficult approach such as L'Ascolto, which extends itself to higher education in its entirety and not to individual parts of it, can significantly contribute to the continuous improvement of the quality of teaching and research in the educational field (specific context), with important reflections on the cultural development of the social

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context (extended context). The main problem in implementing this approach is represented precisely by the way in which the listening and satisfaction of the needs of the customers are achieved, namely with respect to a “specific and extended context”. In particular, the specific context of relations among the needs (translated into targets and evaluated over the time in relation to the satisfaction of the needs themselves L.O.) is satisfied through a plurality of tools, like qualitative, quantitative, evaluation and self-evaluation tests by teachers and students (Selding, 1999, Watson, 1999, Kane R., Sandretto S., Heath C., 2004), sheets of standardization of the professionalism of the teacher and methods (PDCA, QFD), closely related one to each other. The plurality of tools and methods of listening and satisfaction of the needs and their correlation represent a “holistic response” to the complexity of teaching. Applying this approach to the dynamics of higher education processes means being able to process, manage, select and share continuously, over the time, the information (knowledge) generated by this approach. In a broader context it means acting on the cultural change of the social context.

Figure 3 below shows customers’ needs, the response in terms of satisfaction of these needs by L’Ascolto approach and the corresponding problems.

In particular, L’Ascolto tries to bring out clearly, the breadth and boundaries of a specific context of needs, targets and LOs, in the time in which the higher education takes place and with respect to another wider context (social, cultural, economic).

Fig. 3. L'Ascolto and the satisfaction of the needs of a specific context and corresponding problems

“Customer”	Needs	L'Ascolto Approach	Problems
Stakeholder	<p>Professional profiles of CoS in line with market needs</p> <p>Skills (hard and soft) of students corresponding to those declared in the CoS.</p>	<p>Holistic Approach:</p> <p>Continuous, systemic and contextual listening to the needs of all clients and translation of these ones into the educational objectives of CoSs and single teachings;</p> <p>standardization of the processes of collection, selection and management of information deriving from listening to needs (Quality Function Deployment - QFD);</p> <p>Continuous planning, management, evaluation and improvement of all higher education</p>	<p>- difficulty of <u>timely, simplified and continuous</u> access to the information necessary to listen to the needs of all the subjects involved in the higher education, in close relation to</p>

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<p>Institutional bodies</p>	<p>Ability to listen to stakeholders' needs of and to translate them into higher education projects;</p> <p>Quality of provided higher education corresponding to that promise.</p> <p>Management system, standardization and sharing of the knowledge deriving from higher education processes</p>	<p>processes in relation to the objectives to be achieved (satisfaction of needs);</p>	<p>the teaching processes of planning, management, evaluation and improvement;</p> <p>difficulty in processing, selecting and sharing a continuous information flow, deriving from the higher education</p>
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Teacher	<p>Ability to listen and satisfy students' needs in relation to the objectives of the CoS (listening to the needs of stakeholders and institutional bodies); continuous education and training and self-education (in the didactic, disciplinary, pedagogical and communication techniques fields); disciplinary coordination with colleagues; - sharing of best practices; support for effective and efficient management of teaching processes; system of organization and management of knowledge and skills deriving from the higher education processes for the development of research in the didactic field.</p> <p>Cultural revolution</p>	<p>Holistic approach (the same as above) to higher education which allows:</p> <p>Cultural revolution in the professional training of the teacher;</p> <p>systemic and contextual sharing of knowledge for the continuous improvement of education and training processes, to guide research in the higher education field, for continuous self-training (disciplinary, didactic teaching, communication techniques);</p> <p>“standardization” of the design, management, evaluation/self-evaluation processes and improvement of higher education processes as a management support to the teacher;</p> <p>disciplinary coordination among teachers.</p>	<p>processes (design, management, evaluation and improvement) aimed at: support (address) the teacher for continuous improvement; Development of research of didactic field; Continuous self-training of the teacher; Disciplinary coordination among teachers</p>
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Student	Correspondence between acquired education and needs of the context (market); correspondence between the competences declared in the CoS and those actually acquired	clear and continuous sharing of the educational path in terms of objectives to be achieved, objectives achieved or not achieved; active participation in didactic processes (assessment, self-assessment of incoming, ongoing and outgoing education and training).	Difficulties in processing and managing information relating to listening and satisfying students' needs with respect to their context (needs, target, L.O.)
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An objective that can be pursued only with the support of A.I. capable of continuously processing, managing and selecting all the information deriving from the application of L'Ascolto approach, making it usable in a timely and contextual way.

Timeliness regards continuous education processes, in terms of: the processing and management of knowledge deriving from these processes; the selection, standardization and sharing of knowledge; the support/guide to continuous improvement of educational processes.

Ultimately, A.I. allows to process and manage, on a large scale, over the time, the information which comes from listening to and satisfying customers' needs (holistic approach).

In particular, teachers working in the same context (needs, target and L.O.) can share knowledge (best practices) in real time, useful for solving problems in the design, management, evaluation and improvement of educational processes. Furthermore, teachers of the same CoS can coordinate themselves in the disciplinary field with ease and timeliness, without the need to meet themselves. It should also be noted as the continuous and systematic management and sharing of this knowledge supports teacher's self-training,

contributing to his/her professional development, in line with his/her own context (needs, target and L.O.) and in continuous growth. At the same time the support of the A.I. allows to reproduce the design, management, evaluation and guide to improvement which characterize L'Ascolto approach, capable of supporting the teacher in all educational processes and guiding him/her to improvement/innovation without limiting his/her didactic autonomy or debasing his/her professionalism. On the contrary, A.I. elaborating, organizing and selecting knowledge in functional terms ("control areas" of teaching) allows the development of the teacher's professionalism, in the disciplinary field, of teaching methodologies, of communication and relational techniques. Areas that can be expanded in relation to the professional development of the teacher and of the specific context in which higher education is carried out. Ultimately the teacher can count on a guiding and support tool for the continuous improvement of his/her education and the students' one. In this sense, A.I. represents for the teacher a source of knowledge (i.e. control areas) which are strategic for the research development in the didactic field.

With reference to the institutional bodies, there is a clear need for timely information on the results of the educational processes from which the students' learning derives, on the professional development of the teachers, the quality of the provided higher education (gap between promised and delivered education). A.I. allows also to obtain overview data or extreme analysis ones upon the same aspect (knowledge), in relation to the purpose to be achieved. Ultimately, there is the possibility for institutional bodies to be able to count on a data processing system capable of managing and sharing knowledge in continuous improvement, useful for a variety of purposes. Consider, for example, the possibility for a department or university to manage, in a systematic and structured way, a wealth of knowledge (in continuous growth) which represents the creation of value (cultural heritage) of a specific context. Moreover it is possible to consider the possibility of creating research centres on didactic innovation deriving from continuous experimentation of this approach managed with A.I.

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Referring to students, they can access restricted areas where they can manage their educational path, for example, in terms of sharing and active participation in the educational processes and self-assessment of their learning results, over the time.

Conclusions

Aristotle said that all those who meditated on the art of governing humanity are convinced that the empires' fate depends on the education of young people.

One should never stop thinking about the role that education plays with respect to the context in which it operates. Investing in the continuous improvement of the quality of higher education means planning the cultural development of a social context. A.I. is nowadays an expression of the cultural and social mankind development in this century and can play a decisive role in improving the quality of teaching, in particular with respect to holistic approaches to higher education. In this sense the work wanted to present the reasons that led to the translation of a specific holistic approach: L'Ascolto, in algorithms for A.I.

The purpose was to show how the AI. can make a wealth of knowledge available in a simple, timely and continuous manner over time, fed in a structured and systematic way from a holistic approach to higher education (listening). The A.I. in this sense it plays a decisive role, as it allows the gathering, processing, management and selection of the knowledge deriving from all training processes to satisfy the needs of all customers.

In particular, the satisfaction of emerging needs, from a specific context, is intended as a system result and not as the satisfaction of individual customers. In particular, the satisfaction of the needs of a context was intended as: students' learning outcomes (L.O.) with respect to CoS's educational objectives (needs of stakeholders and of institutional bodies); development of the teacher's professionalism with respect to students' educational needs which emerge in relation to CoS's educational objectives; improvement of the quality of the provided higher education with respect to all the needs to be met;

Know-how (schooling, of teaching methods, of communication techniques, of pedagogical skills, etc.) generated by a specific context. If, therefore, a holistic approach to higher education is aimed at listening to and satisfying the needs that emerge from a specific context, as a whole, A.I. can represent the driving force of a cultural revolution that starts from this context, extending it to a much wider one, the social one. The virtuous circuit that is generated is the result of an approach that links everything and everyone, in a systemic, dynamic, contextual and open way. The improvement of a specific context implies systemic contaminations of a much wider context that is the social one. In this sense, A.I. is just a useful tool for mankind, an opportunity to be seized to impressively engrave a change in its own context.

The problem is therefore not the threat that A.I. can represent in mankind future, but the will that men have, of giving to the change, an ethical and moral sense.

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