Rare and contemporary dance as cultural mediators within a b-learning mode: the fuzzy logic perspective

Danze rare e contemporanee come mediatori culturali in un contesto di apprendimento blended: la prospettiva della fuzzy logic

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ABSTRACT The concept of cultural mediation via undergraduate courses in rare and contemporary dance within a blended learning (b-learning) mode is approached here through a fuzzy logic (FL)-based modelling perspective. Students' online interaction on the Moodle Learning Management System (LMS) during such b-learning courses was logged over an entire academic year, and the resulting data were analysed using FL, in order to estimate users' LMS Quality of Interaction (QoI). Using documental analysis, the pedagogical design strategies per semester were transformed into concept maps and related with the dynamically (per week) estimated QoIs. The latter were used by the teachers at the end of the first semester to reflect upon and update their pedagogical planning, so as to enhance QoI in the second semester. The results show the beneficial role of QoI in supporting more dynamic design of educational scenarios, yet considering the inherent tendencies/attitudes of users' interaction within different cultural expressions.

KEY-WORDS Moodle Learning Management System; Quality of Interaction; Blended Learning; Pedagogical planning; Rare and Contemporary Dances; Fuzzy Logic.

SOMMARIO In questo contributo vengono descritti due corsi universitari rispettivamente in danze rare e contemporanee, che sono considerati mediatori culturali. I corsi, erogati in modalità blended, sono stati analizzati con un approccio basato sulla Fuzzy Logic (FL). In particolare, nell'esperienza le interazioni on line degli studenti con una piattaforma Moodle sono state registrate attraverso i file di log durante i corsi per tutta la durata dell'anno accademico, e i dati risultanti sono stati analizzati usando la FL, al fine di stimare la Qualità dell'Interazione (QdI) degli utenti col sistema. Mediante l'analisi documentale, per ogni semestre la progettazione didattica dei corsi è stata rappresentata con mappe concettuali e successivamente messa in relazione con la QdI dinamicamente stimata (per settimana). Quest'ultima è stata utilizzata dai docenti alla fine del primo semestre per riflettere sulla progettazione didattica e aggiornarla, così da potenziare la QdI nel secondo semestre. I risultati dell'esperienza mostrano il ruolo benefico della QdI nel supportare un design più dinamico degli scenari educativi, anche considerando le tendenze e gli atteggiamenti intrinseci dell'interazione degli utenti all'interno delle diverse espressioni culturali.

PAROLE CHIAVE Learning Management System Moodle; Qualità dell'interazione; Blended Learning; Pedagogical planning; Danze rare e contemporanee; Fuzzy Logic.

1. INTRODUCTION

Ideally, dance should represent an expressive synthesis of multiple dimensions that include the cognitive, the physical, the emotional, the cultural, and the socio-political understanding. Fortunately, nowadays several dance educational programs are offering academic courses that encompass the multifaceted nature of dance and, in response, recognize that this calls for different modes of teaching and learning. Instead of binary thinking (practice/studio coupled with theory), dance experiences and intellectual values should be re- imagined in a kind of continuum of creative possibilities (Davenport, 2017). In general, in higher education contexts, dance studies are offered through Arts and Humanities departments, often developing out of the emerging discipline of performance studies, a discipline based in literature studies and languages. Indeed, dance theory has been considered as a new field of study originating in the mid-late 20th century. It includes philosophy, movement analysis and description, and sociological approaches regarding the role of dance in society and culture. At the same time, different fields, such as robotics engineering, psychology and medicine have drawn on theories and concepts from dance studies to explore human movement and social interaction (Biehl, 2017). In this way, cultural studies have considered dance as a culturally fashioned bodily practice with movement exerting influence on the concepts of subjectivity and gender in society (Desmond, 1997; Biehl, 2017).

Furthermore, higher education programs have been influenced by alternative reform movements/pedagogies, promoting more authentic assessment strategies that link theory and practice (Darling-Hammond, 2006; Lampert, 2010; Zeichner, 2006). As a result, during recent years, a noticeable change has occurred in many professional dance preparation programs (Bannerman, 2009; Bannon, 2010). Literature reviews suggest that the dance educational has moved from a narrow disciplinary setting towards a more open and reflective discourse concerning different aspects in both subject matter and teaching/learning styles (Buck, 2006; Bannerman, 2009).

According to Leijen, Lam, Wildschut, and Simon (2009), the pedagogy of dance has changed significantly during the last two decades, especially in Higher Education Institution (HEI) settings. Several studies have underlined that one of the major learning aims in higher education is to enhance dance students' reflection on their learning and behaviour (Leijen et al., 2009; Leijen, Lam, Wildschut, Simons, & Admiraal, 2009a).

More specifically, there is a need for dance teachers and choreographers to stimulate students' ability to reflect on their learning and to enhance their autonomy, creativity and critical thinking skills (Leijen, Admiraal, Wildschut, & Simons, 2008a). While it is undeniably important to train students in dance skills, it is also essential for students to develop an understanding of how dance concepts relate to their particular skills (Doughty, Francksen, Huxley, & Leach, 2008).

Moreover, according to Morris (2012), digital technology applications have started being developed and used across all sectors of the dance training industry (i.e., schools, private dance studios, universities). The digital technologies employed usually include common devices (e.g., computers, smartphones, iPods, video cameras), software for basic audio, video and graphics editing, online content platforms (e.g., YouTube, dance blogs, websites), and specific teaching-learning platforms[1] specially designed for educational institutions (Lepczyk, 2009; Risner & Anderson, 2008). These resources offer different ways to study the contents of the dance discipline and provide easier access to a number of key elements. These include background information, music and footage of dance around the world, closer links with peers and additional contact and feedback from teachers through online communication, and alternative opportunities to develop reflective practice skills, communication and technological skills. In fact, the use of technology within early dance training strengthens the bonds between dance education experiences and dance industry trends and supports a smoother transition into the professional dance sector, where the adoption of digital technology in both creation and performance is increasingly pervasive (Leijen et al., 2009a; Lepczyk, 2009; Risner & Anderson, 2008).

Taking into account the aspects described above, in this paper we describe a fuzzy logic (FL)-based model used in the context of two courses of rare and contemporary dance within a blended (b-learning) environment. The FL model takes into account interactions among users (professors and students) via a Learning Management System (LMS). By translating expert knowledge into fuzzy constructs (Zadeh, 1965), the model performs quantitative estimates of a normalized index of users' Quality of Interaction (QoI). Both students and teachers can use the resulting estimated QoI as effective feedback for metacognitive processes that would allow students to reflect upon their online interaction within the b-learning context and teachers for reconsidering and refining their initial pedagogical planning (Novak & Gowin, 1996) towards more effective dance education scenarios. As already mentioned, this process is exemplified in the paper within two dance paradigms, i.e., rare and contemporary dance disciplines at a HEI, serving as a testbed for the realization of b-learning scenarios.

1.1. *Use of digital technologies in dance education and training*

The connection between dance and technology has started by the time dance teachers and researchers started using analogue video recording to document and analyse dances or dance choreographies (Birringer, 2002). However, research into the influence of technology on dance education, where dance is understood both as a motor skill and as a social and/or cultural work of art, is still in its infancy (Leijen, et al., 2008a). Actually, in the past decade, several studies have focused on the integration of specific ICT tools in the teaching-learning process, such as the use of the YouTube videos. These studies have examined the educational potential of technology enhanced learning in general (e.g., Leo, 2007; Popat & Smith-Autard, 2002) and, in some cases, their application to dance and Greek traditional dance in particular (e.g., Dania, Tyrovola, Koutsouba, & Hatziharistos, 2012; Dania, Tyrovola, & Koutsouba, 2015; Goulimaris, 2015; Antoniou, 2014).

A study performed by Gratsiouni, Koutsouba, Venetsanou and Tyrovola (2016) concerning the field of dance critically investigated the way YouTube acts both as a learning tool and as a teaching result. Through the example of a Greek traditional dance, the Karagouna, the authors assessed what kind of dance can be

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[1] see e.g. http://www.movitae.com

learned using the YouTube videos, whether what is 'learned' is considered correct by dance experts/authorities, and what are the prerequisites of dance videos on YouTube. In general, the results showed that users have a high degree of accessibility to Karagouna dance videos on YouTube, thus these videos may represent a useful resource for learning purposes. However, the authors conclude it would be advisable mainly to adopt ICT tools within practical dance courses to enhance student reflection.

Clearly, more interactive online resources, such as Web-based video applications, can be used for analysing recordings of students' development within a process of a dance course, allowing students to become more explicitly aware of their learning process and reflect on their learning in relation to methodological concepts/principles (Leijen, Lam, & Simons, 2008; Leijen, Admiraal, Lam, Wildschut, & Simons, 2008b).

According to Huddy (2017), the use of interactive technology in dance can be included in three main categories, namely: i) teaching and learning aids, which vary from self-guided learning software and practice companions to applications that guide teachers and students to connect beyond the studio; ii) communication platforms that allow for creative collaboration to occur outside traditional face-to-face (F2F) rehearsals; and iii) technologies that contribute to the creative process itself through various methods, such as developing reflective practice skills that contribute to the establishment of the notion of creativity and ways of mastering it. In their study, Doughty and Stevens (2002) incorporated technology as part of an overall strategy to help students improve and communicate their understanding of dance practice. The main aim of the project was to explore the use of video to facilitate reflection on performance. Participants in the project were dance students enrolled in a level-two contemporary dance technique module. The researchers revealed that the process of viewing, analysing, and assessing student performance through videos played an essential role in teaching, learning, and assessment. Moreover, project findings indicated that those students used to viewing video recordings of their performances were more capable of describing, analysing, and evaluating their practices.

In another study, Leijen et al. (2009a) used a video-based learning environment to enhance students' daily reflection in the context of two courses, one on composition and another on ballet. From multiple learning perspectives, the students in both courses indicated that the video-based learning environment provided a safe environment for sharing ideas with peers.

In the work carried out by Doughty et al. (2008), the authors describe the use of technology as focusing on practice supported by computer-based, audio, video, and interactive technologies, again as a means for enhancing reflection. In addition, the authors reported three different technology-enabled projects related respectively to individual dance learning, group-based dance improvisation and multidisciplinarity in interactive dance practice. These examined learning in the studio classroom and focused on reflective and creative practice in dance enriched by the use of technologies (Doughty et al., 2008).

Based on the findings of these projects, the researchers concluded that technology can enrich dance education in higher education when based on research approaches which take into account what students need for their leaning.

From the aforementioned works, it seems that interactive technologies can increase dance students' autonomous learning and can be used as a means to facilitate and enhance their reflective and creative capabilities. Nonetheless, it appears that further studies are still needed to understand what resources and tools are optimal for supporting students' learning processes in dance courses.

1.2. *Teaching Dance in blended-learning environments*

The Blended Learning (b-learning) mode can address the potential shortcomings of a purely e-learning approach (Wall, 2012), provided that education providers (e.g., HEIs) find the most appropriate blend of conventional and digital learning resources.

Many HEIs/researchers have developed and promoted the use of Learning Management Systems (LMS) for teaching dance (Kavakli, Bakogianni, Damianakis, Loumou, & Tsatsos, 2004; Leijen et al., 2008a; Damianakis, Tsadima, & Tsatsos, 2009). LMS can provide structured access to a collection of online teaching-learning software tools organized in curricular units (e.g., the teaching of dance skills, dance aesthetics, dance history). They can provide the necessary media for lesson planning and presentation in synchronous/asynchronous communication between teachers and students, for performance assessment and lesson administration (Antoniou, Apostolakis, Anastasiades, & Karipidis, 2009). Teaching dance in a virtual format weakens the traditional hierarchical separation between dance experts and learners and dissolves the boundaries between academic disciplines and artistic styles (Caldwell & Milling-Robbins, 2007).

According to Colombi and Knosp (2017), online modes of learning are becoming more interactive and can facilitate creativity in ways that are compatible with dance teaching. The special features of course management systems often make them easy for participants to use, while offering students a familiar social-media-based platform that promotes student engagement.

The use of multimedia tools and online communication affordances, like Google Hangouts, direct posting of videos on YouTube, discussion boards and chats, is consistent with several aspects of Gardner's (2006) multiple intelligence theory and can, thus, enhance student learning. On the other hand, teachers can create courses that continue to embrace different knowledge forms and allow students to grow in diverse learning environments (Colombi & Knosp, 2017).

However, Leijen et al. (2008a) conducted a study analysing dance students' response to the use of the Claroline LMS and concluded that the online environment was mainly used as a repository, contained limited tools (mainly text file support) for facilitating students to carry out and deliver the required learning activities and outcomes. The authors pointed out that the most suitable addition to a conventional online learning environment should be a tool supporting the creation of media files, such as video recordings of rehearsals and performances, allowing students to analyse their own processes and enabling teachers and fellow students to provide feedback and suggestions for improvement.

In fact, developing and deploying programs that are well organized, using multimedia to engage the learner by employing various intelligences, capturing the experiences and knowledge of the learners, while incorporating and promoting interactivity and training instructors to facilitate online delivery, demand strategic decisions to be made at the level of pedagogical planning and adequate resources and tools to be made available to students (Dias, Diniz, & Hadjileontiadis, 2014a). Analysing and evaluating the quality of interactions in blended learning contexts can help finding out what resources and tools better fit the learners' needs.

1.3. *Evaluating the quality of interactions in b-learning environments*

Determining learning behaviour in interacting with electronic media is a complex problem. One difficulty is that these environments are mostly used by students away from the classroom and out of sight of their educators. Without the informal monitoring that occurs in F2F teaching, it is difficult for educators to know how their students are using and responding to these environments. To address this, educators have started exploring new ways of obtaining information about the learning patterns of their students. This clearly requires the development of effective methods for determining and evaluating learner's behaviour in electronic environments (Hijón & Velázquez, 2010), a role that can be facilitated by use of functions offered by LMS.

Evaluation of the Quality of Interaction (QoI) between the learner and online contents is one of the imperative factors determining the efficacy of b-learning towards the creation and maintenance of sustainable learning communities (Grant & Thornton, 2007). So far, works focused on QoI have tended to employ sta-

tistical processing of LMS data, combined with transcript analysis of discussions and exchanges involving teachers and learners within online forums, specifically investigating the dimension, depth and category of exchanges occurred (Ping, Cheng, & Manoharan, 2010).

In this paper, an alternative approach is proposed for estimating LMS users' QoI, based on the fuzzy logic perspective, as explained in subsequent sections. This approach is then applied to the specific case of dance teaching within a b-learning environment.

In the following, we describe the proposed approach, then we present its application in two dance courses. Lastly, we report and discuss the main results.

2. METHODOLOGY: THE FUZZY LOGIC APPROACH

In the effort to develop a system to successfully evaluate users' interaction with the LMS through the QoI, intelligent systems may play an important role, i.e., by providing a model of the domain expert's evaluating system, with the promise of advanced features and adaptive functionality (Levy & Weld, 2000). Based on the latter, Dias and Diniz (2013) proposed a Mamdani-type (Tsoukalas & Uhrig 1996) fuzzy logic-based QoI modelling, namely the FuzzyQoI scheme. The FuzzyQoI model constitutes a Fuzzy Inference System (FIS) structure that is able to produce evaluative inferences upon input data. In particular, the latter correspond to the key parameters and variables (metrics) regarding use of the Moodle LMS employed within a b-learning environment; these data concern the user's interaction with the system, whereas the outputted inference forms a quantitative measure of the user's overall QoI (Dias & Diniz, 2013). The block diagram of the FuzzyQoI model is depicted in Figure 1. This shows users' (professors/students) interaction with the LMS; the 110 available LMS Moodle metrics correspond to 12 categories that serve as inputs to the FIS structure. In an effort to efficiently handle the 12 input variables, these are aggregated into three groups and a nested sequence of five FISs (FIS1-FIS5) is used to form the proposed FuzzyQoI scheme.
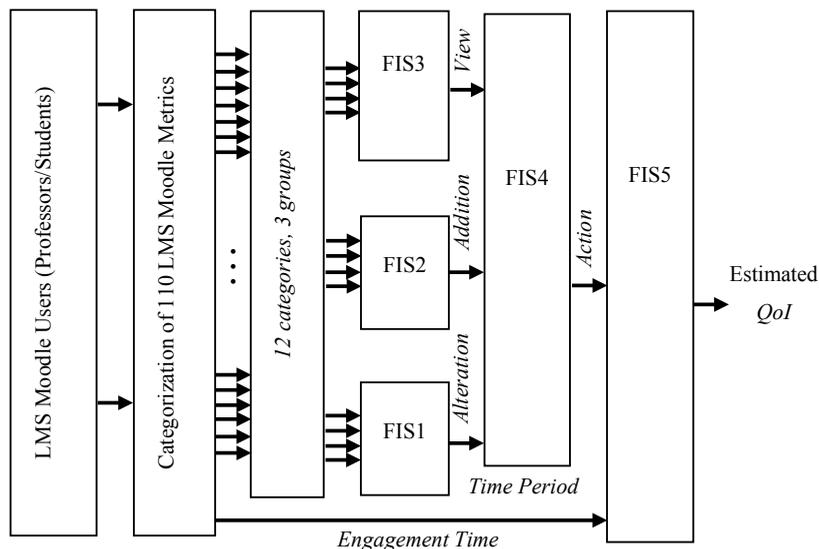

Figure 1. Block-diagram of the FuzzyQoI model (Dias & Diniz, 2013).

[2] A typical Moodle LMS includes 110 metrics related to user activity in the system; theoretically all of these could be used as input variables for the FuzzyQoI model.

The first level includes FIS1, FIS2 and FIS3, which output the values of View (V), Addition (AD) and Alteration (AL), respectively. In the second level of inference, V, AD and AL are considered as intermediate variables and are used as inputs to the FIS4, which outputs the value of Action (AC). Finally, at the third level of inference, the AC is considered as an intermediate variable and, along with Time Period (TP) and Engagement Time (ET), are used as inputs to the FIS5, which outputs the estimated QoI as the final output of the FuzzyQoI scheme (Dias & Diniz, 2013).

For the construction of the knowledge base of the FuzzyQoI scheme, an expert in the field of analysing Moodle LMS data within the context of b-learning was engaged. Specifically, this involved defining the structure of the membership functions used for each FS and the corresponding IF/THEN fuzzy rules.

In particular, three-level trapezoid membership functions corresponding to Low, Medium and High values, respectively, are used for the FIS1-FIS4, whereas five-level trapezoid membership functions corresponding to Very Low, Low, Medium, High and Very High values were adopted for the final FIS5. This helped to increase resolution in the segmentation of the universe of discourse of the AC, TP and ET inputs and QoI output in the final FIS5. Analytical description of the FuzzyQoI model can be found in Dias and Diniz (2013).

3. CONTEXT

In this paper, we report on an experience rooted within the i-Treasures[3], a European FP7 Project in the field of intangible cultural heritage education. The project dedicated particular attention to the design and pedagogical planning of innovative educational interventions in the field of dance. To this aim, specific tools were proposed (namely the Concept Maps and the Pedagogical Planner) in order to support educators; these are described in the following.

3.1. *Concept Maps and Pedagogical Planner tool to support the design of educational scenarios*

In Concept Maps (C-Maps), concepts are arranged as a top-down hierarchy, that is, more general concepts are placed higher on the map and specific concepts are located lower (Novak & Gowin, 1996). C-Maps are widely used in online environments at various stages of the learning process; as a way of promoting discussion and negotiation processes, they can be seen as an extremely valuable learning tool.

In i-Treasures, the use of C-Maps formed part of investigations into the application of learning design and pedagogical planning and was used to support and facilitate educators' creation of educational scenarios (Olimpo et al., 2010). The maps were created using the MindMup tool[4], which was integrated into the Pedagogical Planner, a design tool developed by CNR-ITD (Pozzi, Ceregini, Dagnino, Ott, & Tavella, 2016). The Pedagogical Planner supports the design of pedagogical activities/scenarios, namely the description, at different level of granularity, of how a learning situation or a unit of learning is to be played out. These descriptions include specification of the roles and activities involved in the expected acquisition of a precise body of knowledge. Thus, the Pedagogical Planner (Pozzi et al., 2016), enriched with the capabilities of C-Maps to graphically represent teaching/learning activity design, is essentially a teacher-oriented online tool. In i-Treasures' field tests, investigations and experimentations, the Pedagogical Planner, along with the maps, served as a combinatory tool that incorporates design and planning of educational interventions with feedback from enactment of the b-learning instruction. In this way, causal relations between teachers and students at the level of their LMS-based QoI could be identified, and teachers' metacognitive processes could be directed towards enhancement of the design, planning and delivery of the teaching/learning activities. As explained in the following subsection, this allowed teachers to fine-tune their initial educational scenarios, by adopting resources and tools that best fit emerging

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learner interactions and needs.

As already mentioned, the combination of the FuzzyQoI model with the Pedagogical Planner was applied to the teaching of two dance forms, i.e. rare and contemporary dances; these are used here as paradigms, following the initial effort reported in Dias, Diniz and Hadjileontiadis (2014), and described in the subsequent sections.

3.2. *The dance paradigms*

The data used for the dance paradigms were drawn from the Faculty of Human Kinetics (FHK), University of Lisbon, Portugal, where the corresponding dance courses are delivered using a blended learning approach. The data were categorized into two types: those related to documental analysis of the pedagogical instruction of the disciplines (e.g., curriculum, teachers' planning strategies, online material), and those derived from the Moodle LMS platform. The former were used to formulate transcribed C-Maps within the Pedagogical Planner, representing the design of the teaching/learning activities, whereas the latter were used as input to the FuzzyQoI model for the weekly estimation of the QoI for each user (teachers/students). For either paradigm, the data from two teachers (combined teaching) and 10 students were used and analysed for the duration of two academic semesters (S1: weeks 2-16, S2: weeks 23-38).

3.2.1. *Pedagogical planning of the rare dance course*

Rare dances at the FHK actually belong to the Social Dances discipline. This aims to provide and develop different ways to dance, thus contributing to students' education in a more complete, comprehensive and multifaceted way, through the diversity of approaches and multiplicity of perspectives developed in each dance form. Moreover, the social dimension and respect of the act of dance are taken into account to enhance knowledge and extend the application domain with multicultural approaches, revealing the nature and specificity of their contents. Dance types of various origins are approached and examined: from Greece (e.g., Tsamiko, Omonia), Belgium (e.g., Schaatsenrijdersdans), Serbia (e.g., Savila Se Bela Loza, Vlaški) and other folkloric expressions worldwide. This course is designed to construct a place of experience and experimentation with different materials, both choreographic and contextual, along with specific techniques for analysis, leading to the generation of "know-how" and the enlargement and consolidation of the students' formal and expressive repertoire.

To achieve the above goals within a b-learning environment, both F2F and online learning activities are proposed. Figure 2(a) illustrates the design of the activities envisaged for S1 in the form of the MindMup output, where the F2F and online components are shown in the form of connected branches.

3.2.2. *Pedagogical planning of the contemporary dance course*

Contemporary dances at the FHK are included in the Techniques of Theatre Dances discipline, which aims to promote analysis and study of the motor vocabulary characteristics of modern and classical dance forms. The activities proposed include practice of standardized modelling steps organized in simple exercises with repetitions and chained in sequence dances of increasing complexity. Moreover, attention is devoted to training skills of observation in situations of mutual learning, these being consistent with the principles and quality of dance movements. Through this module, students are expected to be able to:

  i.   know the fundamentals of the techniques of theatrical dance;
  ii. perform the basic vocabulary of theatre dance techniques addressed with correction at the level of bodily vectors and dynamic;
  iii. play with fluency and accuracy through demonstration sequences danced in technical context;
  iv. identify, characterize and describe the specific motor-skill techniques that dance theatre addresses;

v.   cooperate with colleagues in group tasks;

vi.   interact with faculty and/or colleagues by actively participating in the tasks;

vii.   assess their own technical performance and that of others, and

viii.   evaluate their personal participation in groups.
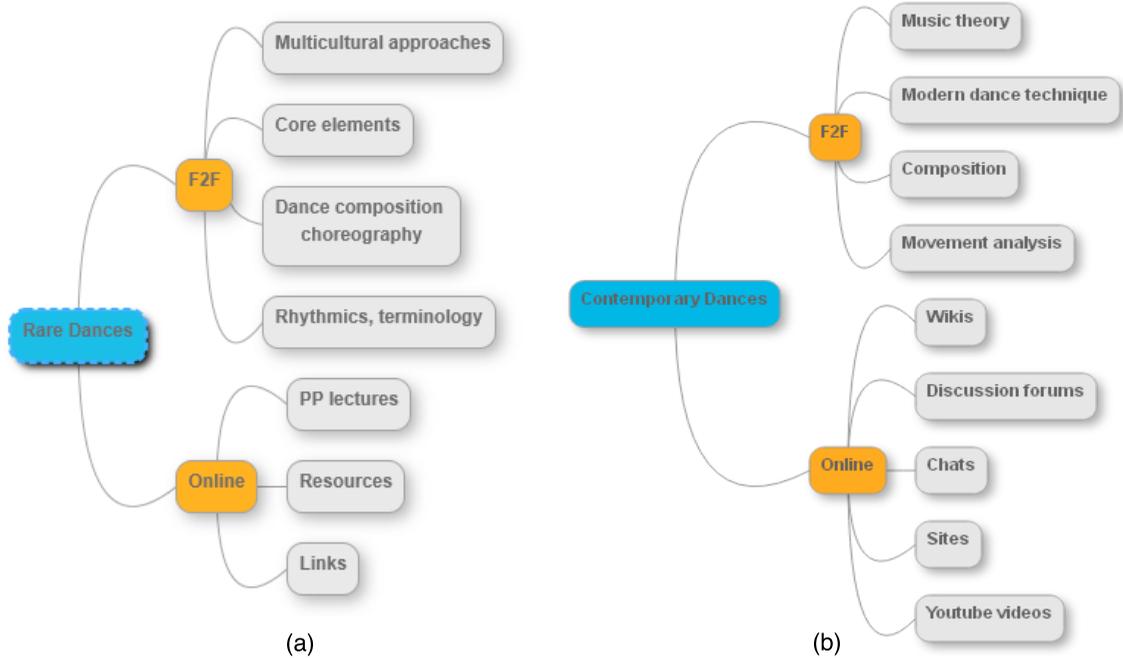

(a)   (b)

Figure 2. C-Mup output of the design of the a) Rare dances course followed throughout S1; and b) Contemporary dances course followed throughout S1.

As in the case of rare dances, the above goals within the b-learning environment are achieved by proposing both F2F and online learning activities for the first semester (S1); their design is represented in the form of the MindMup output, as depicted above in Figure 2(b).

4. RESULTS: Estimated QoI Feedback & Pedagogical Planning Updating

The Moodle LMS user interaction data for S1 and S2 were fed into the FuzzyQoI model, which outputted the corresponding estimated QoIs, i.e., $QoI_{S1,S2}^{RD/CD_{P,S}}$ the superscripts RD and CD indicate rare and contemporary dances, respectively, and P and S refer to professors and students, accordingly. The analytically estimated QoIs for both semesters (S1 and S2) and paradigms are holistically illustrated in Figure 3, whereas the corresponding mean values are depicted in Figure 4.
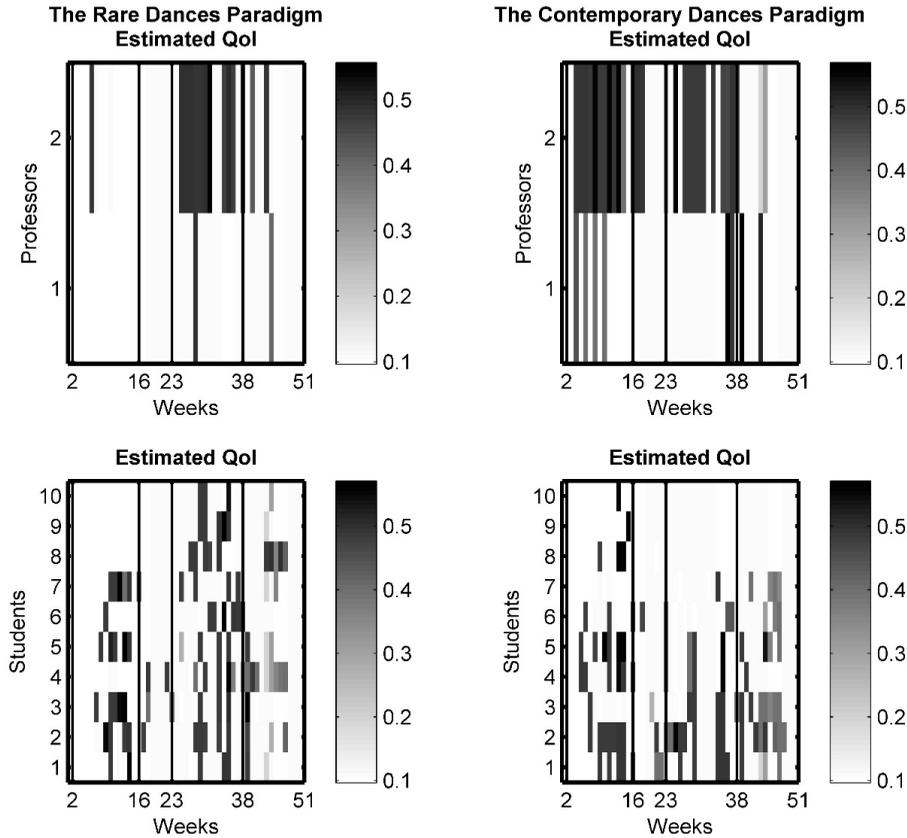
Figure 3. Distribution of the estimated QoI of the rare dance (left column) and contemporary dance (right column) paradigms and corresponding users (professors: top; students: bottom). The S1 and S2 are denoted on the graphs with the vertical solid lines located at Weeks 2 and 16 (S1) and Weeks 23 and 38 (S2).

Although shown in Figures 3 and 4 in a sequential way, the $QoI_{S1}^{RD/CD_{P,S}}$ values were solely presented to the corresponding teachers as feedback at the end of S1. In this way, the teachers could reflect on these outputs and readjust/update the design of the teaching/learning activities envisaged for S2 accordingly, resulting, hence, in the derived $QoI_{S2}^{RD/CD_{P,S}}$ values shown in Figures 3 and 4. This updating process and its effect upon the C-maps are presented in Figures 5(a) and 5(b) for the cases of rare and contemporary dance, respectively. As indicated by Figure 5, in comparison with Figure 2, feedback from the estimated QoI led to changes in the design of the learning activities. This is particularly true for the online components, where an effort is made to increase and/or sustain users' LMS QoI in S2 at higher levels than those in S1.
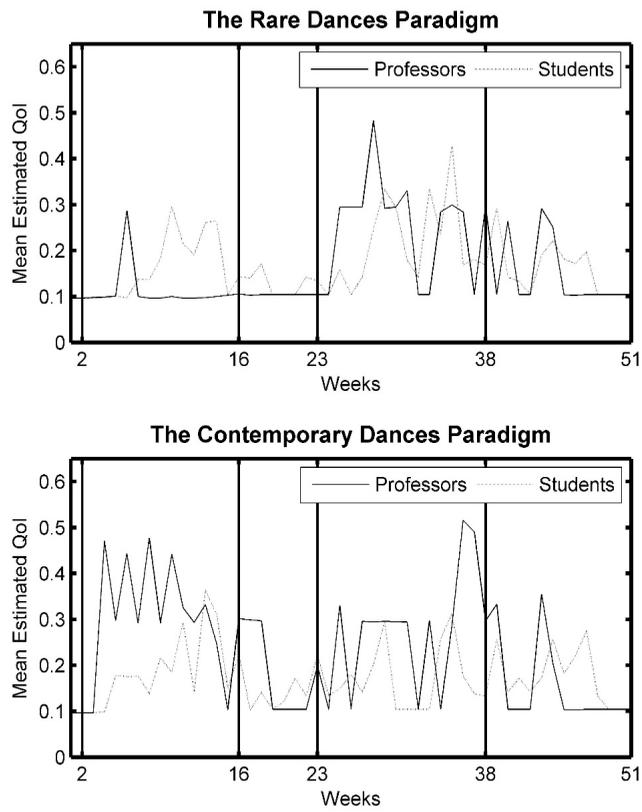
Figure 4. The mean estimated QoI of the rare dance (top panel) and contemporary dance (bottom panel) paradigms and corresponding users (professors: black line; students: grey line). S1 and S2 are denoted on the graphs by the vertical solid lines located at Weeks 2 and 16 (S1) and Weeks 23 and 38 (S2).

5. DISCUSSION

Figure 3 (top panel) clearly illustrates that the two teachers in charge of delivering the respective courses responded differently to the QoI outputs from the LMS. The rare dances Professor #1-RD exhibited sparse interaction with the LMS from the beginning of S2 (Week 23) onwards. By contrast, a significant change is noticed in the QoI of Professor #2-RD, who initiated the LMS-based process at the beginning of S1 (Week 2) and after the QoI feedback she notably increased her QoI. For the case of contemporary dances, Professor #1-CD showed a quasi-periodic interaction with the LMS at the beginning of S1, with abandonment at mid S1 and for almost the whole duration of S2, exhibiting an increased QoI just before the end of S2 (Week 38). On the contrary, Professor#2-CD showed almost constant interaction with the LMS, exhibiting her high QoI values almost across the whole S1 duration and towards the end of S2.

Regarding students' QoI values, these were higher at S2 than in S1 for the rare dances case, whereas the opposite effect was noticed for students in the contemporary dance course.

Focusing on the mean estimated QoI in Figure 4, it is clear that the effect of the professors' QoI feedback was higher in the case of the rare dances (top panel) than for contemporary dances (bottom panel). Clearly, the QoI peak for rare dances at Week 5 for the whole of S1 has been extended to more sustained QoI values across

S2, peaking also at ~0.5 after the beginning of S2. This change in the professors' QoI is probably connected with the noticeable change in the students' QoI. In fact, in S1, a hysteresis-like effect is noticed, as students' QoI starts growing only after the professor's peak at Week 5, which peaks around the mid S1 and tends to decay towards the end of S1. On the contrary, the performance is totally different in S2, as the students show a tendency to exhibit synchronized QoIs with those of their professors, justifying the more active role of the LMS part in the b-learning activities during S2. In the case of contemporary dances, the hysteresis-like effect is seen between the professors' and students' QoI during S1. Here, despite the high QoI of the professors, the students' QoI exhibits a gradual increase towards the end of S1, whereas the updating of the pedagogical planning by the professors in S2 contributed mostly to synchronization between the professors' and students' QoIs. In both cases, the professors acted in a reflective way by adjusting the initial design of the learning activities for S2 and exhibited increased QoI (in both cases the QoI peaks are located within S2).

Turning to the C-Map updating process shown in Figure 5, the shift towards more interactive and appealing online resources (e.g., quizzes, discussion forums, blogs, videos, e-portfolios) increased interest towards
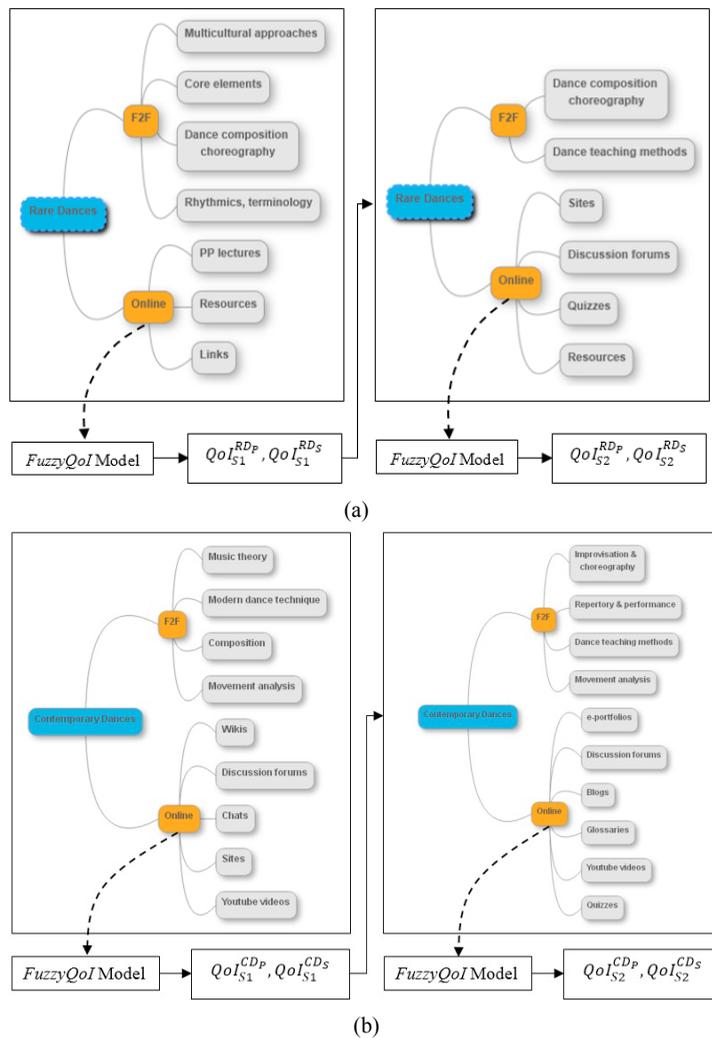

(a)

(b)

Figure 5. A schematic representation of how teachers made use of the QoIs, as estimated via the Fuzzy-QoI model, as feedback/input for redesigning activities and updating C.Mup outputs. The two figures on the left refer to S1, while the two on the right regard S2. The top two figures (a) refer to the rare dances paradigm, while the bottom two (b) regard contemporary dances.

LMS interactions, which may have been seen as a richer source of information, able to accompany the F2F interactions and complement the effort towards multifaceted ways of learning. Here it should be noted that contemporary dance embeds more complex expressive issues, compared to the rare dances, as it refers to contemporary mankind. This is the "fixing" of the present – here and now – when the dance becomes a kind of scan of the psychological, social, political processes taking place in the life of modern people.

This is far more complex than equivalent processes in the era of rare dances, when dance forms were simpler and had less expressive scope, which was mainly influenced by local cultural habits, religion and political dependences.

From the paradigms presented here it seems the proposed approach helped teachers to improve their designs, by choosing better and more effective resources and tools that provide more opportunities for communication, in such a way that the QoI then improved.

The proposed approach could be extended to various educational scenarios and use-cases, lending a dynamic dimension to pedagogical planning and shifting towards an intelligent LMS (Dias, Diniz, & Hadjileontiadis, 2014a). This could assist both teachers and students to enhance reflection and improve the quality of the educational environment.

6. CONCLUSIONS

This contribution reported an effort to combine the process of pedagogical planning within a b-learning context with the employment of users' QoI in LMS, considered as effective feedback. A fuzzy logic-based modelling approach, namely FuzzyQoI, was adopted to provide reliable estimates of the QoI (both for teachers and students) across two semesters of two academic dance courses, respectively addressing rare and contemporary dances. The results presented here show the beneficial role of QoI in constructing more dynamic design of educational scenarios in dance, while taking into consideration the inherent tendencies and attitudes of user interaction within different cultural expressions.

7. ACKNOWLEDGMENTS

8. REFERENCES

Antoniou, P. (2014). The Video in Teaching Dance. The Approach of YouTube. *Science of Dance*, *7*, 11-46.

Antoniou, P., Apostolakis, N., Anastasiades, P., & Karipidis, A. (2009). Teaching physical education issues in the compulsory education using digital learning environments. In A. Méndez-Vilas, A. Solano Martín, J.A. Mesa González & J. Mesa González (Eds.), *Research, Reflections and Innovations in Integrating ICT in Education* (pp. 819-824). Badajoz, SP: Formatex.

Bannerman, C. (2009). Viewing a/New: The Landscape of Dance in 2009. *Research in Dance Education*, *10*(3), 231-240. doi:10.1080/14647890903347114

Bannon, F. (2010). Dance: The possibilities of a discipline. *Research in Dance Education*, *11*(1), 49-59.

doi:10.1080/14647890903568313

Biehl, B. (2017). *Dance and Organization: Integrating Dance Theory and Methods into the Study of Management*. Oxon, UK: Taylor & Francis.

Birringer, J. (2002). Digital performance: Dance and media technologies. *Performing Art Journal*, *24*(1), 84-93.

Buck, R. (2006). Teaching Dance in the Curriculum. In D. Kirk, D. Macdonald, and M. O'Sullivan (Eds.), *Handbook of Research in Physical Education* (pp. 703-719). London, UK: Sage. doi:10.4135/9781848608009.n39

Caldwell, L. A., & Milling-Robbins, S. (2007). Teaching dance in an online setting. *Journal of Dance Education*, *7*(1), 25-29. doi: 10.1080/15290824.2007.10387329

Colombi, E., & Knosp, S. (2017). Teaching Dance with Online Course Management Systems. *Journal of Dance Education*, *17*(2), 73-76. doi:10.1080/15290824.2016.1228108

Damianakis, A., Tsadima, E., & Tsatsos, D. (2009). OpenDance: A program for learning traditional dances with the use of distance education learning tools. In P. Politis (Ed.), *Proceedings of the 1st Educational Congress "Incorporation and use of ICT in the educational process"*, Volos, Greece (in Greek).

Dania, A., Tyrovola, V., Koutsouba, M., & Hatziharistos, D. (2012). Labankido©: The Evaluation of a Multimedia Tool Designed for the Teaching of Basic Skills and Concepts in Dance Education. *International Journal of Sport & Society*, *3*(3), 137-148.

Dania, A., Koutsouba, M., & Tyrovola, V. (2015). The ability of using symbols and its contribution to dance learning: The Laban notation system. *Choros International Dance Journal*, *4*, 37-49.

Darling-Hammond, L. (2010). Teacher Education and the American Future. *Journal of Teacher Education*, *61*(1-2), 35-47. doi:10.1177/0022487109348024

Davenport, D. (2017). Dance is Academic. *Journal of Dance Education*, *17*(1), 34-36. doi:10.1080/15290824.2016.1177642

Desmond, J. (1997). *Meaning in motion: New cultural studies of dance*. Durham, NC: Duke University Press.

Dias, S. B., & Diniz, J. A. (2013). FuzzyQoI Model: A fuzzy logic-based modelling of users' quality of interaction with a learning management system under blended learning. *Computers & Education*, *69*, 38-59. doi:10.1016/j.compedu.2013.06.016

Dias, S. B., Diniz, J. A., & Hadjileontiadis, L. J. (2014). On Enhancing Blended-Learning Scenarios through Fuzzy Logic-Based Modeling of Users' LMS Quality of Interaction: The Rare & Contemporary Dance Paradigms. In S. Battiato (Ed.), *Proceedings of the 9th International Joint Conference on Computer Vision, Imaging and Computer Graphic* (Visigrapp/Iamich 2014) Vol. 2 (pp. 765-772). Lisbon, PT: Science and Technology Publications (Scitepress). doi: 10.5220/0004861507650772

Dias, S. B., Diniz, J. A., & Hadjileontiadis, L. J. (2014a). *Towards an Intelligent Learning Management System under Blended Learning: Trends, Profiles and Modelling Perspectives*. Berlin/Heidelberg, DE: Springer-Verlag. doi:10.1007/978-3-319-02078-5

Doughty, S., & Stevens, J. (2002). Seeing Myself Dance: Video and Reflective Learning in Dance Technique. *Paper presented at the 'Finding the Balance' conference on Dance in FE and HE in the 21st Century*. Liverpool, UK: John Moore's University.

Doughty, S., Francksen, K., Huxley, M. & Leach, M. (2008). Technological Enhancements in the Teaching and Learning of Reflective and Creative Practice in Dance. *Research in Dance Education*, *9*(2), 129-146. doi:10.1080/14647890802088041

Gardner, H. (2006). *Multiple intelligences: New horizons*. (completely revised and updated). New York, NY: Basic Books.

Goulimaris, D. (2015). The relation between distance education students' motivation and satisfaction. *Turkish Online Journal of Distance Education*, *16*(2), 13-27. doi:10.17718/tojde.50678

Grant, M. R., & Thornton, H. R. (2007). Best Practices in undergraduate adult-centered online learning: mechanisms for course design and delivery. *Journal of Online Learning and Teaching*, *3*(4), 346-356.

Gratsiouni, D., Koutsouba, M., Venetsanou, F., & Tyrovola, V. (2016). Learning and Digital Environment of Dance–The Case of Greek Traditional Dance in YouTube. *European Journal of Open, Distance and E-learning*, *19*(2), 80-95.

Hijón, R. N. & Velázquez, A. I. (2010). From the discovery of students access patterns in e-learning including Web 2.0 resources to the prediction and enhancement of students outcome, e-learning experiences and future. In S. Soomro (Ed.). *E-learning Experiences and Future*, InTech (chapter 14, pp. 276-294). doi:10.5772/8802

Huddy, A. (2017). Digital technology in the tertiary dance technique studio: expanding student engagement through collaborative and co-creative experiences. *Research in Dance Education*, *18*(2), 174-189. doi:10.1080/14647893.2017.1330327

Kavakli, E., Bakogianni, S., Damianakis, A., Loumou, M., & Tsatsos, D. (2004). Traditional dance and e-learning: The WEBDANCE learning environment. In *International Conference on Theory and Applications of Mathematics and Informatics* (ICTAMI 2004) (pp.272-281). Thessaloniki, GR.

Lampert, M. (2010). Learning Teaching in, from, and for Practice: What Do We Mean? *Journal of Teacher Education*, *61*(1-2), 21-34. doi:10.1177/0022487109347321

Leijen, Ä., Lam, I. & Simons, P. R. J. (2008). Pedagogical Practices of Reflection in tertiary Dance Education. *European Physical Education Review*, *4*(2), 223-241. doi:10.1177/1356336X08090707

Leijen, Ä., Admiraal, W., Wildschut, L., & Robert-Jan Simons, P. (2008a). Students' perspectives on e-learning and the use of a virtual learning environment in Dance education. *Research in Dance Education*, *9*(2), 147-162. doi:10.1080/14647890802087951

Leijen, Ä., Admiraal, W., Lam, I., Wildschut, L., & Simons, P. R. J. (2008b). A Pedagogy before Technology: What should and ICT Intervention Facilitate in Practical Dance Classes? *Teaching in Higher Education*, *13*(2), 219-321. doi:10.1080/13562510801923351

Leijen, Ä., Lam, I., Wildschut, L. & Simon, P. R. J. (2009). Difficulties Teachers Report about Students' Reflection: Lessons Learned from Dance Education. *Teaching in Higher Education*, *14*(3), 315-326. doi:10.1080/13562510902898882

Leijen, Ä., Lam, I., Wildschut, L., Simons, P. R. J., & Admiraal, W. (2009a). Streaming Video to Enhance Students' Reflection in Dance Education. *Computers & Education*, *52*, 169-176. doi:10.1016/j.compedu.2008.07.010

Leo, L. (2007). Corposcopio: An interactive installation performance in the intersection of ritual, dance and new technologies. *Technoetic Arts*, *5*(2), 113-117. doi:10.1386/tear.5.2.113_1

Lepczyk, B. (2009). Technology Facilitates Teaching and Learning in Creative Dance. *Journal of Physical Education, Recreation & Dance*, *80*, 4-8. doi:10.1080/07303084.2009.10598330

Levy, Y. A., & Weld, S. D. (2000). Intelligent Internet Systems. *Artificial Intelligence*, *118*, 1-14. doi:10.1016/S0004-3702(00)00013-8

Morris, G. (2012). Problems with Ballet: Steps, Style and Training. *Research in Dance Education*, *4*(1), 17-30.

Novak, J. D., & Gowin, D. B. (1996). *Learning How to Learn*. Cambridge University Press. New York.

Olimpo, G., Bottino, R. M., Earp, J., Ott, M., Pozzi, F., & Tavella, M. (2010). Pedagogical Plans as communication oriented objects. *Computers & Education*, *55*(2), 476-488. doi:10.1016/j.compedu.2010.02.011

Ping, T. A., Cheng, A. Y., & Manoharan, K. (2010). Students' interaction in the online learning management systems: A comparative study of undergraduate and postgraduate courses. In *Proceedings of the AAOU-2010 Annual Conference* (pp. 1-14). doi:10.1108/AAOUJ-06-01-2011-B007

Popat, S., & Smith-Autard, J. (2002). Dance-making on the internet: can on-line choreographic projects foster creativity in the user-participant? *Leonardo*, *35*(1), 31-36. doi:10.1162/002409402753689281

Pozzi, F., Ceregini, A. Dagnino, F., Ott, M. & Tavella M. (2016). Closing the "learning design lifecycle" with the Pedagogical Planner. *European Journal of Open and Distance Learning*, 103-116.

Risner, D., & Anderson, J. (2008). Digital Dance Literacy: An Integrated Dance Technology Curriculum Pilot Project. *Research in Dance Education*, *9*(2), 111-126. doi:10.1080/14647890802087787

Tsoukalas, H. L., & Uhrig R. E. (1996). *Fuzzy and Neural Approaches in Engineering*. New York, NY: Wiley & Sons.

Wall, J. (2012). Strategically integrating blended learning to deliver lifelong learning. In J. L. Moore (Ed.) *International Perspectives of Distance Learning in Higher Education* (pp 133-148). Rijeka, HR: InTech. doi: 10.5772/34686

Zadeh, A. L. (1965). Fuzzy sets. *Information and Control*, *8*, 338-353. doi:10.1016/S0019-9958(65)90241-X

Zeichner, K. (2006). Reflections of a University-based Teacher Educator on the Future of College- and University-based Teacher Education. *Journal of Teacher Education*, *57*(3), 326-340. doi:10.1177/0022487105285893