

# Teaching and Learning Technologies in Higher Education: Applied Behaviour Analysis and Autism; “Necessity is the Mother of Invention”

Lise Roll-Pettersson<sup>1</sup>, Shahla Ala'i-Rosales<sup>2</sup>, Mickey Keenan<sup>3</sup>, and  
Karola Dillenburger<sup>4</sup>

<sup>1</sup>Stockholm University, <sup>2</sup>University of North Texas, <sup>3</sup>University of Ulster, and <sup>4</sup>Queens University, Belfast

Professionals on both international and national levels who work with children with autism are expressing the need for graduate-level training in applied behaviour analysis. The implementation of effective instruction in higher education for professionals working with children with autism and their families is a complex undertaking; the learner needs to acquire an understanding of the principles and procedures of applied behaviour analysis and also adapt this knowledge to the learning prerequisites of individuals with autism. In this paper we outline some current thinking about adult education and blended learning technologies and then describe and illustrate with examples emerging possibilities of multimedia technology in the development of teaching materials. We conclude that synergies between graduate-level curriculum requirements, knowledge of adult learning, and communication technology are necessary to establish comprehensive learning environments for professionals who specialize in autism intervention.

*Key words:* applied behavior analysis, higher education, autism, teaching technologies

---

The implementation of effective instruction in higher education for professionals working with children with autism and their families is complex: not only does the learner need to acquire an understanding of the principles and procedures of applied behaviour analysis but s/he also needs to be able to apply these to autism interventions. In essence, a professional who is appropriately trained in behaviour analysis and autism intervention should be able to understand and interpret autism diagnostic procedures; implement and utilize direct and indirect assessments; discern non-evidence-based from evidence-based practices; select and apply procedures as appropriate; be proficient in functional assessment and analysis, data collection and evaluation procedures; and problem-solve effectively when children are not making progress.

However, as noted in the introduction to this special section, few universities worldwide offer higher education programs in applied behaviour analysis that are accredited by the Association for Behaviour Analysis International (ABAI) and approved by the Behavior Analytic Certification Board (BACB) for Certification (see Weiss & Shook, 2010). Even fewer have higher education programs that combine autism and applied behaviour analysis courses which meet consumer guidelines for autism specialists (see Weiss & Shook) and also fulfil university validation standards.

In many places throughout the world the demand for behaviour analytic supports and services for individuals with autism far outweighs the availability of graduate-level courses. This situation has led to professionals who lack both adequate knowledge and relevant

experience claiming (and probably honestly believing) they are proficient in behaviour analysis and working as supervisors. This is disturbing for a number of reasons. First, the quality of behavioural interventions may be compromised or diluted and children and families may suffer (Bibby et al., 2002). Also, limited or inappropriate training may lead to the spread of misinformation and pose a threat to the field's integrity and credibility. For example, in Sweden and Northern Ireland, countries with limited formal university training in behaviour analysis, there are a significant number of professionals who provide "behavioural" consultation to children/individuals with autism, their families, and schools. Unfortunately, these people may have obtained their "behavioural" training through short courses, in-service training or workshops as opposed to a full-fledged, competency-based graduate-level program. This has led, in part, to a situation in which interventions are based on a recipe-based cookbook or "supermarket" approach (Keenan et al., 2007) and thus are not adequately adaptable to the learning history of the individual or current contextual contingencies in the learning environment, both of which are essential features in applied behaviour analysis.

One way to deal with the discrepancy between demand and available university-based academic programs in the field of applied behaviour analysis as it applies to autism is international curriculum development through collaboration between universities across the globe. The purpose of this paper is to provide a rationale for the development of national-international university collaboration and highlight components to accomplish this. Such collaboration would require the use of blended learning technologies and benefit from advances in instructional design and innovative media technologies. First, this paper presents a brief description of issues and findings regarding adult education with an emphasis on guided design. Second, an overview of blended learning technologies is offered as a viable means of training applied behaviour analysts who specialize in autism intervention. Finally, the potential of using multimedia in adult education is discussed.

## Teaching and Learning in Higher Education

Teaching and learning in higher education is an emerging multi-faceted field that, during the last two decades, has gained recognition as a distinct area of scholarship. According to Bernstein and Bass (2005), "scholarly teaching" focuses on learning, inquiry, and effective teaching practices aimed at improving the quality of higher education. It has both an individual arena (improving teaching practice) and a broader agenda concerned with the relationship between technology and learning. The authors maintain that the genre for informing the public of scholarly teaching is undergoing substantial change; they argue that new forms are needed to replace traditional methods of scholarship. Bernstein and Dotson (2010) provide a description of the challenges higher education institutions are confronted with when devising academic programs for the development of complex repertoires and competencies required of autism specialists in applied settings. Regarding education practice in general, the National Research Council (NRC) (Bransford et al., 2000) maintains that the field of teaching and learning is in paradigm shift: re-conceptualizing what is taught; how it is taught; and how learning is assessed. Donovan, Bransford, and Pellegrino (2008) summarized some key elements and implications of NRC synthesis and underscored the importance of attending to the following three research-based elements: (1) instructors need to be aware that adult learners may bring to the learning experience misconceptions that hinder their understanding of the knowledge and concepts being communicated. Instructors need to be able to detect what information is needed regarding this issue and be prepared to provide support; (2) deep level of factual knowledge and mastery of concepts in the field being studied is a prerequisite for expertise; (3) monitoring and problem-solving skills are essential, and strategies to develop these skills can be taught. These elements and their implications are especially important in the context of cross-cultural collaboration when designing and implementing courses.

Based on NRC recommendations, Trivette, Dunst, Hamby, and O’Herin (2009) synthesized 79 adult-learning experimental studies and found that the following six characteristics were significantly related to positive learning outcome: (1) engaging the learner in activities *prior* to instructor presentation (for example, out-of-class activities, self-instruction, pre-class quizzes or warm-up exercises); (2) illustration of the use of the new knowledge, material, or practices through role-play or simulations; (3) combining real-life activities and role-play for practicing the newly learned knowledge, material, or practice; (4) evaluation through assessment of the strengths and weaknesses of the application or practice, and providing the learner with feedback for solutions; (5) learner reflection regarding next steps to proceed; and (6) engagement in self-assessment.

### Guided Design

The guided-design approach to teaching is congruent with the recommendations proposed by the NRC (Trivette, 2005). Guided design is rooted in instructional strategies developed in the field of engineering in the late 1960’s and focuses on promoting student understanding of content knowledge, critical thinking, and self-directed learning. According to Trivette (2005), four essential elements characterize the guided-design approach: “(1) a sequential process for mastering course content, (2) a team or small group processing component, (3) the provision of verbal or written feedback from a facilitator/teacher as a professional in the field concerning the solution reached or decision made, and (4) the use of realistic problems to be solved” (p. 2). Taken together, in order to advance from novice learner to expert, the individual needs to be involved in guided instruction, actively participate in the learning process, be exposed to multiple learning experiences and opportunities, and engage in self-assessment as well as instructor-facilitated assessment based on preset criteria (op cit). A synthesis of 35 studies that used guided design and measured student outcome found that guided design facilitated the retention of instructional content,

student application of course content to realistic problems, and learner satisfaction (op cit). Given the nature of the knowledge, interpersonal, and problem-solving skills required by behaviour analysts in autism, guided design seems an especially appropriate approach.

### Supervision

Studies within the field of behaviour analysis have shown that possibly the most important instruction strategy affecting the transfer of behaviour analytic knowledge to real-life settings is the quality and intensity of supervision (Jahr, 1998; Smith, Groen, & Wynn, 2000; Eikeseth, Hayward, Gale, Gitelsen, & Eldevik, 2009; Eikeseth 2010; Ingvarsson, Camillari, & Smith, 2010). Yet time spent on a supervision site is not necessarily equivalent to high quality supervision nor does it guarantee competency-based skill acquisition (Greer & Koehane, 2004). The provision of instructions, performance criterion, modelling, rehearsal, practice procedures and systematic feedback are ingredients found to be necessary in competency-based supervision (see e.g. Ryan, Hemmes, Sturme, Jacobs & Grommet, 2008; Harchik, Anderson, Thomson, Forde, Feinberg, Rivest, & Luiselli, 2001). Intensity of high quality supervision is not only critical for skill acquisition, it also functions as a safeguard against poor treatment integrity and low treatment adherence (Allen & Warzak, 2000; Sholomskas, Syracuse-Siewert, Rounsaville, Ball, Nuro, & Carroll, 2005). Studies also indicate that contingencies such as previous experience and education may need to be taken into consideration when determining intensity of supervision (Chu, 2008; Cuccaire, Weingardt & Villafranca, 2008; Sholomskas et al., 2008). Though there are behaviour analytic studies in the field of autism demonstrating functional relationships between child-skill attainment and the training of therapists, Follette and Callaghan (1995) note a lack of empirical behaviour analytic studies that critically look at how supervision is implemented. They contend that most behaviour analytic papers on supervision are descriptive rather than experimental

and that the main instructional strategy used by supervisors is some form of direct instruction. The authors argue that although direct instruction is necessary, it may have limitations, and that reliance on rule-governed approaches may lead to the supervisee becoming inflexible and less sensitive to current environmental stimuli and situational changes. On a different note, Gibson, Grey, and Hastings (2009) studied the relationship between supervisor support and burnout among applied behaviour therapists who provide one-on-one teaching to children with autism. They found that good supervisor support prevented emotional exhaustion and correlated with positive perception of accomplishment, that is, therapists who had unsupportive supervisors were more likely to experience exhaustion (see also Dillenburger, 2004). In summary, further empirical research is needed concerning supervision models and their impact on practitioners' performance and wellbeing. These issues are especially pertinent when designing blended learning courses across cultures.

### Distance and Blended Learning Technologies

Distance learning is documented as an effective method in regard to the dissemination of empirically-supported interventions and academic knowledge. For example, Vismara et al. (2009) conducted a quasi-randomized study to test the effectiveness of distance learning vs onsite learning for training community-based therapists in four sites on the Early Start Denver Model (ESDM). Interactive video conferencing was used in the distance learning group both regarding disseminating didactic information and providing supervision to participants on their videotaped probes; onsite learning methodologies were used in the other group. The results revealed that distance learning and traditional onsite learning were equally effective for teaching participating therapists to implement EDSM as well as training parents to implement the model. This is promising, but from an international perspective it is likely that sole reliance on distance learning

may backfire should content and examples not be adapted to the cultural contingencies of the learner. Hence, blended learning (BL) or hybrid learning, which entails innovatively combining traditional class meetings (classroom, campus) with online learning, including interactive video lectures, software applications, web-based environments, live e-learning, and other computer-mediated technologies, holds promise. As Bonk (2006) pointed out, a major advantage of blended learning is that curriculum and course content can be tailored to meet the needs of specific consumers, populations, and cultures; as such, BL has the potential for synchronizing students and instructors with expertise throughout the world.

Each of the above-mentioned technologies can be matched in various ways in order to achieve instructional objectives. A useful metaphor for picturing how to design a BL course is the image of building blocks. The building elements involved in designing a blended course in behaviour analysis are depicted in Figure 1. This schema is adapted from the work of Cucciare, Weingardt, and Villafranca (2008) based on their research on training evidence-based therapy techniques to clinicians. Starting at the bottom of Figure 1, it should be noted that there is a deep and solid foundation which consists of three basic elements. At the bottom foundation level is the *basic platform*, which involves designing a course in which students are conceived as interactive learners, and content and procedures represent the best available information in the field. This entails that the course is designed and evaluated based on its effectiveness in teaching the students the desired content and skills. The second foundation element consists of clear and measurable specifications of *course objectives*. In this case, learner objectives are behaviour analytical and adhere at minimum to the parameters specified in the BACB task list, ABAI, and autism SIG consumer guidelines (Weiss & Shook, 2010). The final foundation element involves consideration of the *course parameters*: how long will the course last (days, months, years); in what order should blended instruction be delivered (sequentially,

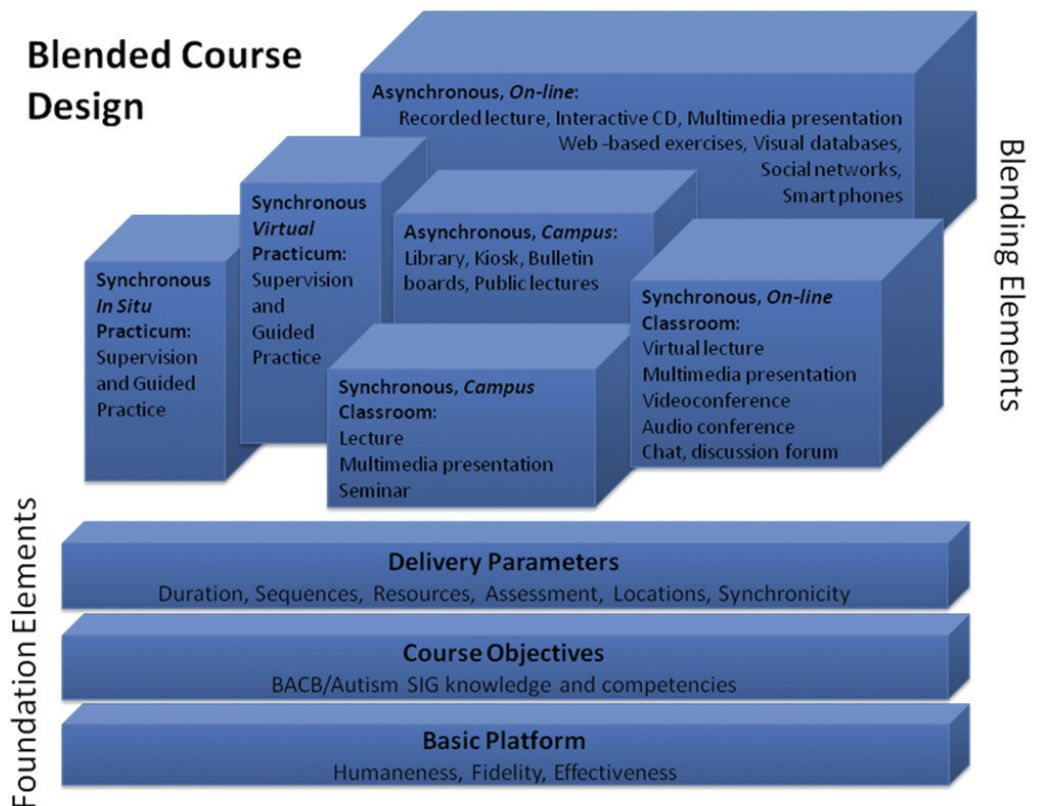


concurrently); what are the available resources (financial, technological, human) for course design?; and where should learning take place? (campus and/or online classrooms, in situ and/or virtual practicum, and campus and/or online venues). Finally, synchronicity requirements need to be considered (do instructional activities need to take place at the same time or can they occur at different times?).

Once the foundation elements are understood and in place, course designers can begin blending blocks of building elements. These elements are presented in the top portion of Figure 1. Note that the choice and size of the block will vary from course to course. In the case of advanced training in autism, this involves choices between *synchronous campus and/or online classrooms* (depending on available faculty resources and need for immediate and human interaction), *asynchronous campus and/or online experiences* (depending on experiences that are not necessarily sequential or involve human

timing elements), and *in situ and/or virtual practicum and guided experience* (depending on ethical factors, the skills being taught, and the efficacy of remote or delayed feedback). Within each of these choices, a number of media combinations are available to the blended course designer. It is important to note that advances in technology are occurring at rocket speed regarding both blended delivery mechanisms and multimedia options. In fact this is occurring at a much faster pace than the science of how the new products/modalities affect learning. In all likelihood, the future holds technological resources (as well as pitfalls) that are beyond our imagination. In that regard, the specifics presented here are possible but not exhaustive options for the design of a blended course.

Blended learning has the potential to capitalize on the advantages within a variety of learning systems (Bonk, 2006; Chen, Klein, & Minor, 2009; Graham, 2006; Roll-Pettersson & Ala'i-Rosales, 2009).



Adapted from Cuccaire, Weingardt & Villafrance, 2008

Figure 1: Blended Learning Course Design Elements

Bonk et al., 2006 contend that BL may be especially suitable for learners who live in locations that do not have access to a specific content (e.g., where behaviour analysis is not offered at a university), or whose life situation is such that they may want the convenience of online learning but do not want to forfeit the social interaction offered by in-class teaching. We suggest in this paper that BL may be one way of solving the crisis confronting universities and clinics worldwide to address the need for professionals trained in behaviour analysis who are competent in assessing, designing, implementing, and supervising programs for individuals with autism.

Two studies have specifically addressed the use of BL when teaching advanced professionals working with children with disabilities (Chen, Klein, & Minor, 2009; Roll-Pettersson & Ala'i-Rosales, 2009) and can serve as case examples for the higher educator wishing to design and implement a BL course. An overview and comparison of each of the course designs are presented in Table 1. The first case example was conducted by Chen, Klein, and Minor (2009) and involved a BL early childhood course for 110 professionals from different disciplines. The course focused on techniques for working with families and sharing information concerning the roles, responsibilities, and practices of the selected disciplines. The rationale for conducting the course was that families of children with multiple disabilities often have contact with several disciplines, necessitating the need to coordinate as well as implement family centred supports and services. In addition, the authors noted that several disciplines (i.e., occupational therapists, speech and language therapists, and physiotherapists) were not provided with sufficient early intervention content knowledge in their pre-service degrees. Thus, BL was used to provide information about working with families, thereby filling in a pre-service training gap.

In the second case example, Roll-Pettersson and Ala'i-Rosales (2009) tailored a BL course to introduce the scientist-practitioner model of applied behaviour analysis to a group of professionals working with children with autism. The course was specifically designed to address the accelerating demand by families, rehabilita-

tion centres, and preschools/schools for effective interventions. Since other graduate academic training in Sweden did not correspond to national (Bohlin et al., 2004) or international competency recommendations or task lists in behaviour analysis (BACB, 2010), the course used BL to minimize the discrepancy between stakeholder demand and available national expertise. The results of both studies suggest that the BL course design permits content adaptations in instructional activities and outcomes that may not be feasible in a traditional campus-based or online course design. While these case examples illustrate two different effective configurations of elements presented in Figure 1, several issues related to the selection of instructional materials in a BL course warrant justification and description.

## Material

In the remainder of this paper we will take a closer look at multimedia teaching materials as a way of improving the effectiveness of BL congruent with adult learning and which facilitates the dissemination of and training of behaviour analysis. It is impossible to communicate the utility and possibility of multimedia within the limitations of the printed/written word (Keenan, 2003). For this reason we are describing the materials used in blended learning environments in two ways. First, multimedia webpages are presented as an integral part of this paper exposing the reader to a small sample of blended learning while reading an academic paper. Once you have explored the online resources by clicking on the url below, the technical details will be described in a traditional way in the remainder of this paper.

<http://tinyurl.com/38q2k91>

## Multimedia Technology in Teaching

Though multimedia material can be quite costly to produce and place technical demands upon the ingenuity and energy of the teacher, results from several studies indicate that when blended with other genres of instruction such as readings and discussion, its application in real

or pseudo-real environments increases engagement and in-depth learning (see Chu, 2008). While several aspects of interactive multimedia still need empirical documentation, it seems apparent that a well-designed multimedia program, whether interactive or presented together with a telecom interactive discussion format,

can facilitate learning among students in a BL course. Additional advantages of adapting multimedia have been described by Zemke and Zemke (1995), who found that with regard to the needs of mature learners, a multimedia environment provided them with flexibility in time and control over the educational process.

<b>Study</b>	<i>Interdisciplinary Perspectives in Early Intervention (Chen, Klien &amp; Minor, 2009)</i>	<i>Using Blended and Guided Technologies in a University Course for Scientist Practitioners (Roll-Pettersson &amp; Ala'i-Rosales, 2009)</i>
<b>Background</b>	Critical need for specific knowledge expressed by stakeholders: 1) lack of graduate courses in early intervention and 2) working with families of children with multiple disabilities from an interdisciplinary perspective.	Critical need of specific knowledge expressed by stakeholders: 1) absence of graduate courses in applied behaviour analysis with a focus on autism meeting the BACB requirements and 2) access to experts and research literature.
<b>Aim</b>	Promotion of interdisciplinary training and collaboration for children with severe disabilities.	Promotion of the scientist-practitioner model, combining international expertise with the eco-cultural needs of the students.
<b>Participants</b>	110 professionals from a variety of disciplines working in early intervention; early childhood specialists, nurses, speech- language therapists, psychologist/social workers, occupational therapists, and physical therapists; California	23 professionals working with children with autism; educators, early childhood educators, psychologists, speech- language therapists, and occupational therapist; Sweden
<b>Course Content</b>	Derived from stakeholders input: state agency administrators, service providers, and university faculty with specific expertise.	Derived from stakeholders input: government administrators, students, and BACB requirements. Financing was contingent on requirements for certification and degree.
<b>Course Instructors</b>	Primary instructors: Tenured university faculty with cross-disciplinary backgrounds; CSU instructors and "visiting instructors" with expertise in specific disciplines.	Primary instructors: Two tenured university faculty at Stockholm University, Sweden and University of North Texas, United States.
<b>Instructional Elements</b>	Interactive discussions; guided design (vignettes and case studies), modelling, assignment feedback; self and guided reflection exercises; quizzes and tests.	Interactive discussions; guided design (roleplays, scenarios and case studies), modelling, assignment feedback; application projects; guided reflection exercises; quizzes and tests.
<b>Blending Elements</b>	Face to face orientation and final debriefing; CD lectures; online discussions and chats; online quizzes and written assignments; videoconference observations.	On-site (face to face) meetings, lectures, and presentations interspersed throughout course; CD lectures; interactive telecom lectures; moodle web based communication; written assignments; library assignments; field projects.
<b>Evaluation</b>	Pre-post tests (student evaluation of changes in knowledge and skills, overall perception of course, challenges and benefits, influence on practice) and three year follow-up survey.	Student course evaluation (modified version of Grey et al 2005); opened ended student evaluations; outcomes of experimental teaching projects.

Table 1. Two Examples of Blended Learning and Adult learning instructional approach

Not only can multimedia products strengthen factual knowledge and mastery of concepts, Ellis (2001) found that educational products that were enhanced with multimedia proved effective in promoting critical thinking in adult students. Multimedia education tools have been used to teach urology to undergraduate medical students (Teichman, 1999), improve health outcomes of children with asthma (Krishna et al., 2003), improve nutrition education in at-risk populations (Carroll et al., 1996; Jantz, Anderson, & Gould, 2002), teach the basics of ABA to parent of children diagnosed with ASD (PEAT, 2010), and allow cancer patients to make informed treatment choices (Diefenbach & Butz, 2004).

Over the past seventeen years, Keenan (1993; 1997; 2003; 2004; 2010) has designed and produced numerous multimedia packages to facilitate the learning of behavioural concepts, principles, and procedures directed at promoting critical thinking skills (Keenan & Dillenburger, 2000a; 2001; 2004; Keenan et al., 2003; PEAT, 2007; 2010). The following two figures illustrate some of the multimedia teaching materials designed for some of these packages.

Figure 2 uses the imagery of a celestial sphere to portray the paradigm shift in which a person peeks into a new world that is “outside” the sphere, and is different from the world known to her/him from which s/he comes; i.e., “inside” the sphere (Keenan, 2010). In the present context, this image portrays the student as scientist in his/her quest for knowledge. When the scientist explores a new world outside the “known,” s/he is faced with a problem when it comes to communicating the findings and new information to others who have not themselves explored the world “outside”; that is, who have not experienced other ways of thinking. Using this image allows students in blended learning courses to explore their own perspective as learners as well as issues they will face once they have completed the course. In a BL course this image could be used to initiate synchronous or asynchronous discussions or offer a stimulus for group or individual projects.

The image in Figure 3 provides an example of how interactive media can be used in combination with written media to train would-be therapists in the principles and application of behaviour analysis. Consider that the learning environment provides opportunities for the



Figure 2: The Celestial Sphere



instructor to use a range of stimuli and contingencies to enhance learning. The instructor's role is to present the information and interact with the students in such a way that s/he not only memorizes the material but also becomes engaged in it, which, of itself, is an important goal; novice learners in behaviour analysis are being prepared to "enter the world of the scientist" so that they themselves may eventually be able to contribute to the field.

In the traditional classroom, learners are often exposed to a summary of research findings in the form of a flat two-dimensional graph. Keenan and Dillenburger (2000b) drew attention to the increased likelihood of the learner attaining a deeper understanding when this sort of discriminative stimulus ( $S^D$ ) is contrasted with a moving visual image that shows what the scientist did and which explain the significance of the findings. Often, the graph is the only  $S^D$  available to the teacher to help achieve his/her objectives.

Picture a group of students who are invited to the preview of a new movie. Seated in the auditorium they are given a brief overview of the movie by the director. The lights dim and the curtains open to

the sound of rapturous applause. In the subsequent silence the students are treated to pages of text projected onto the screen. Punctuated throughout the text are two-dimensional black and white Tables and Figures that summarize aspects of the plot (p. 21).

In the interactive multimedia illustration in Figure 3 each dot (i.e., data point) has been made into a clickable button that presents a video clip. An additional function of such a set-up from a BL perspective is that on-site instructors with limited personal experience of scientist-practitioner procedures can present successful research-based procedures in a more meaningful way.

This image, then, suggests how the BL instructor's teaching can be transformed with the integration of new and old media in a meaningful way. To proceed a step further, imagine how teaching assignments would change if articles from research journals could be downloaded wherein all the data points in the results section could be clicked to show video clips of procedures and actual behaviour. That would surely help in the dissemination of good practice as well as support critical and reflective thinking skills (see Keenan, 2010, pp. 21-23).



Figure 3: Clickable data points that show movies

Of course, once familiar with this kind of data presentation, student assignments could include requirements like the provision of detailed video evidence which would allow the instructor to assess not only effectiveness of an intervention but also assess the rapport between instructor and child/parent.

### **Visual Database**

When a higher education instructor is asked by his/her department to teach in an area outside of his/her personal training it would be desirable for him/her to be able to turn to articles with active data points in the way described above. It would also be useful to be able to access a database of video clips showing examples of behavioural competencies across a wide range of other applied areas.

### **Animations**

Keenan and Dillenburger (2009) explored the usefulness of animations for tackling complex issues such as mentalism. They have also used animations and extensive video footage in the multimedia training package called SIMPLE STEPS (PEAT, 2010). This package is presently being extended and translated into European and Indian languages. Preliminary feedback from the United Kingdom, United States, Germany, Norway, Spain, and India indicates that there is dire need for such high quality multimedia teaching materials worldwide. The development of well-designed, tested, and culturally adapted multimedia packages is imperative for clarifying procedures and principles of behaviour analysis as they relate to autism. Ideally, similar packages would be developed for other areas where behaviour analysis is utilised.

For those who wish to explore further the development of their own interactive animation for instructional purposes there is a wealth of available software (e.g., GoFigure, 2009). Motion Capture is another avenue within this area that holds much promise (Motion Capture, 2009). Actors wear special suits and their actions are recorded in such a way that they can be used to animate 3-D characters. Gaining access

to authentic video clips can raise ethical dilemmas, especially when the behaviour of interest is severely challenging. These problems could be bypassed when actors play out the scenes associated with challenging behaviour and its treatment, so that a whole treatment program is animated with 3-D characters from different ethnic backgrounds, in different languages.

### **Conclusion**

The ultimate goal of this paper is to improve treatments for individuals with autism. It is our hope that the reader will use ideas presented here to design and implement culturally-adapted BL courses. Of primary concern is that content in graduate courses are updated on current evidence of what behaviour analysts working with children with autism need to know; the courses should integrate pedagogies from the best available research on adult learning and instructional practices. We suggest that the instructor begin by using Figure 1 to ensure that courses are based on the most current information; and that there are clear, measurable course objectives and parameters, including where and when learning will take place. Research to-date indicates that it is possible to incorporate adult learning theory within a blended learning paradigm. Blended learning offers opportunities for universities worldwide to collaborate, ensuring adult learners access to the information they are searching. Course designers must remember that adult learners might have preconceptions about how children with autism learn and develop. To meet this challenge, BL instructors need to design and tailor culturally responsive courses and supervision consistent with the diverse learning histories of their students. The integration of well-designed multimedia technology with BL and adult learning theory may facilitate learning factual material, promote critical thinking and in-depth learning, and contribute significantly to training competent behaviour analysts internationally. Opportunities therefore need to be available so that professional development for instructors can keep abreast of new technological developments. Adult education is a burgeoning field presently undergoing a paradigm shift.

To this end, higher education instructors could be portrayed in the celestial sphere (Figure 2) as persons who are at the forefront of changing perspectives, looking from the 'known' to the new.

## References

- Allen, K.D. & Warzak, W. J. (2000). The problem of parental nonadherence in clinical behavior analysis: Effect treatment is not enough. *Journal of Applied Behavior Analysis*, 33, 373-191.
- Behavior Analysis Certification Board (BACB) (2010) *BCBA® & BCaBA® Behavior Analyst Task List*. Retrieved from the Web 03/08/2010 [http://www.bacb.com/consum\\_frame.html](http://www.bacb.com/consum_frame.html)
- Bernstein, D & Bass, R (2005). *The Scholarship of Teaching and Learning*. Retrieved from the Web 24/04/2010 <http://www.aaup.org/pubres/academe/2005/JA/Feat/bern.htm?PF=1>
- Bernstein, D. & Dotson, W. (2010). Promoting Teaching Excellence in Professional Education of Behavior Analysis. *European Journal of Behavior Analysis*, in press.
- Bibby, P., Eikeseth, S., Martin, N.T., Mudford, O.C., & Reeves, D. (2002). Progress and outcomes for children with autism receiving parent-managed intensive interventions. *Research in Developmental Disabilities* 23, 81-104.
- Bohlin, G., Bromark, G., Granat, T., Haglund, N., Sjöholm-Lif, E. & Zander, E. (2004). *Mångsidiga intensiva insatser för barn med autism i förskoleåldern: En rapport inom projektet evidensbaserad habilitering (Comprehensive Intensive Interventions for Preschool Children with Autism: A Report within the Project Evidence-Based Habilitation)*. Föreningen Sveriges Habiliteringschefer/ Handikapp och Habilitering (The Swedish Association for Habilitation Employers): Stockholm läns landsting.
- Bonk, C. J. & Graham, C. R (2006). *The Handbook of Blended Learning: Global Perspectives, Local Designs*. San Francisco: Pfeiffer, An imprint of Wiley.
- Bransford, J. D., Brown, A. L., Cocking, R. R., Donovan, M. S. Bransford, J. D. & Pellegrino, J. W. (Eds.). (2000). *How People Learn: Brain, mind, experience, and school*. Washington DC: National Academy Press.
- Carroll, J. M., Stein, C., Byron, M., & Dutram, K. (1996). Using interactive multimedia to deliver nutrition education to Maine's WIC clients. *Journal of Nutrition Education*, 28, 19-25.
- Chen, D., Klein, D., & Minor, L. (2009). Interdisciplinary perspectives in multiple disabilities through distance education. *Infants and Young Children*, 22, (2), 146-158.
- Chu, B. C. (2008). Empirically supported training approaches: The who, what, and how of dissemination psychological interventions. *Clinical Psychology: Science and Practice*, 15, (4), 308-312.
- Cucciare, M. A., W., Weingardt, K. R., & Villafranca, S. (2008). Using blended learning to implement evidence-based psychotherapies. *Clinical Psychology: Science and Practice*, 15, 299-307.
- Diefenbach, M. A. & Butz, B. P. (2004). A multimedia interactive education system for prostate cancer patients: Development and preliminary evaluation. *Journal of Medical Internet Research*, 6.1.e3.
- Dillenburger, K. (2004). Causes and alleviation of occupational stress in social work. *Multi-disciplinary Journal of Child Care in Practice*, 10, 213-224.
- Donovan, M. S., Bransford, J. D., & Pellegrino, J. W. (Eds). (2008). *How People Learn: Bridging research and practice*. Washington DC: National Academy Press.
- Ellis, T. J. (2001). Multimedia enhanced educational products as a tool to promote critical thinking in adult students. *Journal of Educational Multimedia and Hypermedia*, 10, 107-124.
- Eikeseth, S. (2010). Examination of Qualifications Required of an EIBI Professional. *European Journal of Behavior Analysis*, in press.
- Eikeseth, S., Hayward, D., Gale, D., Gitelsen, J-P., & Eldevik, S. (2009). Intensity of supervision and outcome for preschool aged children receiving early and intensive

- behavioral interventions: A preliminary study. *Research in Autism Spectrum Disorders*, 3, 67-73.
- Follette, W. C., & Callaghan, G. M. (1995). Do as I do, not as I say: A behavior-analytic approach to supervision. *Professional Psychology: Research and Practice*, 26, 413-421.
- GoFigure (2009). *Animate*. Retrieved from the Web 06/22/2009. <http://www.gofigure3d.com/site/>
- Gibson, J.A., Grey, I. M., & Hasting, R. P. (2009). Supervisor support as a predictor of burnout and therapeutic self-efficacy in therapists working in ABA schools. *Journal of Autism and Developmental Disorders*, 39, 1024-1030.
- Graham, C. R. (2006). Blended learning systems: Definition; Current trends, and Future Directions. In C. J. Bonk & C. R. Graham (Eds). *Handbook of Blended Learning: Global Perspectives, Local Designs*: San Francisco, Pfeiffer, An Imprint of Wiley (Chap. 1, p. 3-21).
- Greer, R. D., & Keohane, D. (2004). A real science and technology of teaching. In D. J. Moran & R. W. Malott, (Eds.), *Evidence-Based Educational Methods* (pp. 23-46). New York: Elsevier/Academic Press.
- Harchik, A. E., Anderson, M., Thomson, R., Forde, K., Feinberg, L., Rivest, S & Luiselli, J. K. (2001). Evaluation of a participatory, competency-based model of staff training in a community habilitative center. *Behavioral Interventions*, 16, 1-13.
- Ingvarsson, E.T., Cammilleri, A.P., & Smith, C. (2010). Behavior analysis and performance-based change: Relevance for university training to prepare autism specialists. *European Journal of Behavior Analysis*, in press.
- Jahr, E. (1998). Current issues in staff training. *Research in Developmental Disabilities*, 19, (1),73-87.
- Jantz, C., Anderson, J., & Gould, S.M. (2002). Using computer-based assessments to evaluate interactive multimedia nutrition education among low-income predominantly Hispanic participants. *Journal of Nutrition Education and Behavior*, 34, 252-260.
- Keenan, M. (1993). Behavioral community? *Behavior Analysis Newsletter*, 16, 9.
- Keenan, M. (1997). W-ing: Teaching exercises for radical behaviourists. In K. Dillenburger, M. O'Reilly, & M. Keenan (Eds). *Advances in Behaviour Analysis* (pp 48-80). Dublin: University College Dublin Press.
- Keenan, M. (2003). (Printed) Words alone. *European Journal of Behaviour Analysis*, 4, 70-74.
- Keenan, M. (2004). Autism in Northern Ireland. The tragedy and the shame. *The Psychologist*, 17, 72-75.
- Keenan, M. (2010). *The dot as and SD*. Retrieved from the Web 05/03/2010 [http://web.me.com/mickeykeenan/The\\_dot\\_as\\_an\\_SD/Intro.html](http://web.me.com/mickeykeenan/The_dot_as_an_SD/Intro.html).
- Keenan, M. & Dillenburger, K. (2000a). *Behaviour Analysis. A primer*. A multimedia tutorial. [Computer software] New York: Insight Media
- Keenan, M. & Dillenburger, K. (2000b). Images of behavior analysis: The shaping game and the behavioral stream. *Behavior & Social Issues*, 10, 19-38.
- Keenan, M. & Dillenburger, K. (2001). *The Stream Machine: A template for the analysis of behaviour*. [Computer software]. Cambridge Centre for Behavioural Studies at [www.behavior.org](http://www.behavior.org)
- Keenan, M. & Dillenburger, K. (2004). *Why I'm not a cognitive psychologist. A tribute to BF Skinner*. [Computer software]. New York: Insight Media.
- Keenan, M. & Dillenburger, K. (2009) *Celtic Fringe Productions*. Retrieved from the Web 06/22/2009. <http://www.celticfringe.me.uk>
- Keenan, M. & Dillenburger, K., (2010). If all you have is a hammer ... RCTs and hegemony in science. *Research in Autism Spectrum Disorders*. doi:10.1016/j.rasd.2010.02.003
- Keenan, M., Dillenburger, K., Doherty, A., Byrne, J., & Gallagher, S. (2007). *Meeting the needs of families living with children diagnosed with autism spectrum disorder*. (Final Report. pp.184). Coleraine, NI: University of Ulster.
- Keenan, M., Gallagher, S., Dillenburger, K., & Nikopoulos, C., (2003). *Learning to observe*. [Computer software]. New York: Insight Media.



- Krishna, S., Francisco, B.D., Balas, E.A., König, P., Graff, G.R., Madsen, R.W. (2003). Internet-enabled interactive multimedia asthma education program: A randomized trial. *Pediatrics*, *111*, 503-510.
- Motion Capture (2009). *Motion Capture*. Retrieved from the Web 06/22/2009. <http://www.motioncapture.com/>
- Parents' Education as Autism Therapists (PEAT, 2007) SIMPLE STEPS. Retrieved from the Web 09/01/2007) [http://www.peatni.org/simple\\_steps/index.asp](http://www.peatni.org/simple_steps/index.asp)
- Parents' Education as Autism Therapists (PEAT, 2010) *STAMPPP Science and the treatment of autism. Multimedia package for parents and professionals*. Retrieved from the Web 03/10/2010 [http://www.peatni.org/euro\\_commission\\_llp.asp](http://www.peatni.org/euro_commission_llp.asp).
- Roll-Pettersson, L. & Ala'i-Rosales, S. (2009). Using blended and guided technologies in a university course for scientist-practitioners: teaching applied behaviour analysis to autism professionals. *Journal of Intellectual Disabilities*, *13*, (2), 113-142.
- Ryan, C. S., Hemmes, N. S., Sturmey, P., Jacobs, J. D., Grommet, E. K. (2008). Effects of a brief staff training procedure on instructors' use of incidental teaching and students' frequency of initiation toward instructors. *Research in Autism Spectrum Disorders*, *2*, (1), 28-45.
- Sholomskas, D.E., Syracuse-Siewert, G., Rounsaville, B. J., Ball, S. A., Nuro, K. F. & Carroll, K.M. (2005). We don't train in vain: A dissemination trail of three strategies of training clinicians in cognitive-behavioral therapy. *Journal of Consulting and Clinical Psychology*, *73*, 1, 106-115.
- Smith, T., Groen, A.D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation*, *105*, (4), 265-285.
- Teichman, J. (1999). Multimedia-based education may be used to teach urology to undergraduate medical students. *Urology*, *53*, 267-270.
- Trivette, C. (2005). Effectiveness of guided design learning strategy on the acquisition of adult problem-solving skills, *Bridges, practice-based research syntheses: Research and training center on early childhood development*, *3*,(1), 1-18.
- Trivette, C. M., Dunst, C. J., Hamby, D. W., & O'Herin, C. E. (2009). Characteristics and consequences of adult learning methods and strategies. *Winterberry Research*, *2*, (2), 1-33.
- Vismara, L.A., Young, G. S., Stahmer, A. C., Mahaon Griffith, E. & Rogers, S. (2009). Dissemination of evidence-based practice: Can we train therapists from a distance? *Journal of Autism and Developmental Disorders*, *39*, 1636-1651.
- Weiss, M. J., & Shook, G., L. (2010). Resources on training requirements for applied behavior analysts: The Behavior Analyst Certification Board and the Autism Special Interest Group Consumer Guidelines. *European Journal of Behaviour Analyses*, in press.
- Zemke, R. & Zemke, S. (1995). Adult learning: What do we know for sure? *Training*, *32*, 31-40.