

A Learning Object Approach To Evidence based learning

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ABSTRACT

This paper describes the philosophy, development and framework of the body of elements formulated to provide an approach to evidence-based learning sustained by Learning Objects and web based technology

Due to the demands for continuous improvement in the delivery of healthcare and in the continuous endeavour to improve the quality of life, there is a continuous need for practitioner's to update their knowledge by accomplishing accredited courses. The rapid advances in medical science has meant increasingly, there is a desperate need to adopt wireless schemes, whereby bespoke courses can be developed to help practitioners keep up with expanding knowledge base. Evidently, without current best evidence, practice risks becoming rapidly out of date, to the detriment of the patient.

There is a need to provide a tactical, operational and effective environment, which allows professional to update their education, and complete specialised training, just-in-time, in their own time and location.

Following this demand in the marketplace the information engineering group, in combination with several medical and dental schools, set out to develop and design a conceptual framework which form the basis of pioneering research, which at last, enables practitioner's to adopt a philosophy of life long learning.

The body and structure of this framework is subsumed under the term Object oriented approach to Evidence Based learning, Just-in-time, via Internet sustained by Reusable Learning Objects (The OEBJIRLO Progression). The technical pillars which permit this concept of life long learning are pivoted by the foundations of object oriented technology, Learning objects, Just-in-time education, Data Mining, intelligent Agent technology, Flash interconnectivity and remote wireless technology, which allow practitioners to update their professional skills, complete specialised training which leads to accredited qualifications.

This paper sets out to develop and implement a range of teaching and learning strategies that would accommodate the flexibility required by such a scheme. At the same time the specific requirements of individual programmes are satisfied.

The body of elements provide an integrated path taking students through the range of operational, tactical and strategic issues involved in Web Based Learning, sustained by learning object abstract framework and Agent technology, within a distant learning context.

Keywords

Learning objects, Distance learning, Web-learning technology, virtual universities, Agent technology, Data Mining

Introduction

Over the past five years or so medical and dental education, along with other aspects of clinical practice and the wider socio-medical/dental environment, has changed significantly and continues to change significantly.

As such education is being perceived as a life long learning endeavour for the practitioner. It is seen a relevant and vibrant process. Indeed, continuing professional development (CPD) is

now mandatory and a legal requirement for the dental profession and for professionals complementary to dentistry (PCD).The emphasis being on eliciting, acquiring and integrating a type of expertise and knowledge to benefit the practitioner [1]

The OEBJIRLO conceptual model framework, promotes the concept of mobile learning (m-learning)[17], by providing a model where by practitioners can utilise remote wireless, portable technology from any location, however remote, for studying either accredited courses leading to a specific qualification or research intensive courses. Furthermore the model also envelops an Agent technology concept, which will systematically design a module of study for the practitioner. The model further perpetuates a data mining formulation, which allows practitioners to drill down for specific journals and the formulation automatically presents similar relevant articles

The enabling technology is manifested by the dissemination of the global medium; the internet , and the provision of portable, light weight Personal Access Device (PAD), enhanced with flash technology and voice commands. This paper proposes to illustrate how the unsullied internet technology along with video conferencing and the learning objects teaching content model, can be the driving force that totally changes the way, evidence based practice is practiced. For example, in dentistry, the use of the Internet with web casting is being evaluated as part of a European Educational Social Fund Programme (ESF) providing up-to-date CPD for 100 dental practices and pharmacies (<http://www.kcl.ac.uk/eucpd>).

Due to the change in the pattern of practitioner's working lives and the greater variety of specialised skills needed at short notice, the team proposes that a just-in-time approach offers a solution, and this also suits a design which uses learning objects in a relatively granular fashion. Just as with manufacturing, it is an approach that can only work effectively where it makes use of the newest technology. [2]

The paper describes how the concepts of real world objects, classes and inheritance, which are the basic building blocks for object oriented technology along with 3D modelling graphic and web-based design application can form foundations for evidence-based learning applications and an engine for FAQ. The object oriented infrastructure behind this new web-based technology will allow professionals, who have moved out of the teaching environment to experience and take advantage of a new type of learning; e-learning, distant learning and virtual education. Moreover, the OEBJIRLO conceptual framework forms a backbone to a structure, which provides a means to providing tailor made courses, who's component units are independent and autonomous and assimilated Just-in-time. These learning objects are powerful concepts that are used to promote evidence based learning as self-standing, reusable, discrete pieces of content that meets an instructional objective. Additionally the establishment provides for global coverage, enabling professionals to update their professional and surgical skills by watching video based conferences and surgical procedures powered by vector based and zoom technology and

educational data mining, thus enabling them to balance the conflicting demands on their professional time

The evidence for success of this singularity has been verified by the case study Meditutor. The rudiments of this case study embrace and perpetuate the OEBJIRLO skeleton and the OEBJIRLO object model. The paper further proposes to expand this concept by incorporating 3D visual models of artefacts, from the Gordon medical Museum, which can be zoomed to give an invaluable teaching environment that can be accessed by students universally

The paper further illustrates, how the manifestation of the OEBJIRLO structure embodied within the confines of the case study, gave rise to the formulation of an interactive medical college, a virtual learning institution, enabling professionals to complete accredited courses in specialised areas of study, form the comfort of their own home, at a time convenient to them

What is Evidence-based learning?

The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research. Generally doctors and dentists use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannised by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient. In order to ensure patients get the best possible healthcare, it is imperative that practice continues to embrace medical and dental advances.[3][4]

The need for Evidence-based learning on the web sustained by Reusable Learning objects

Medical students during their training and apprenticeship followed a structured approach to learning, studying modules, which were established on groundbreaking research, which reflected new practices at the time. This form of teaching was complemented by student being able to direct clinical questions to senior lectures. This knowledge prepared them well for the real world. However once moved out of the teaching environment this model is difficult to implement. Much of what has learned in medical school is no longer true although practitioners recognise the need to continually update their knowledge, and technical skills, there is a huge demand on their professional time to deliver quality healthcare to patients.

and unfortunately sources of information and consultancy are distributed by location. These limitations have been the rationale, which prevented practitioners from expanding their field of knowledge. Per se there is a need to embrace methods to keep up with new advances.

The OEBJIRLO structure addresses this shortfall and aligns a method of approach for progressive learning, via a framework of lectures sustained by learning objects, which can be assimilated anytime, and from any location. It lays a structured pathway for accredited distant learning courses, and provides a mechanism for customised study courses, which can be created anytime encompassing reusable objects such as interactive surgical procedures. The reusability of learning objects allows the lowering of costs, as course development programs can be created without creating everything from scratch, and allows course content to be applied to a much larger number of students.

Just-in-Time (JIT)

JIT manufacturing became widely popular in the 1980s. The ideal was to have components from a variety of manufacturers arrive at the factory assembly line just in time for production to start. They would not be stockpiled, or held for any length of time. The JIT concept as applied to education has some

elements of the manufacturing model JIT education happens when it is needed and therefore waste, in the form of surplus stockholding (courses run at under-capacity) or lost opportunities (lack of training places at the right time on the right courses for the right people) would appear to be less likely to occur. The student practitioner draws down the learning opportunity, in conjunction with the agent technology, which automatically assimilates the courses to suit their needs and timetable. The learning product may be created 'on-the-fly,' not existing before it is asked for, and tailored to some extent to the practitioner's requirement in terms of volume and specification. It has sometimes been described as 'just-for-you' as well as just-in-time. [2]

Typically just-in-time also means that the training or learning is delivered at the desktop or PDA of the practitioner. This has tended to dictate a pattern of devising activities that take only a small amount of time to complete and can be entered or exited frequently so that they can be studied alongside the normal work of the practitioner. Most importantly it recognises that what most practitioner's want is 'just enough' information or knowledge at the right time rather than spending time acquiring knowledge on a 'just-in-case' basis.[2]

What are Learning Objects?

The paper proposes that the underlining theoretical framework is formulated on Learning objects because they are new a concept and are ideal for education as they can be defined as any entity, digital or non-digital, that may be used for learning, education or training. [5]. They can be seen as 'any digital resource that can be reused to support learning.' [5]. This definition includes smaller reusable digital resources such as digital images or photos, live or pre-recorded surgical video or audio snippets, animations. This definition also supports larger reusable digital resources such as entire web pages that combine text, images and other media or applications to deliver complete dental and medical experiences, such as a complete instructional event. Furthermore Learning Objects provide a new way of thinking about learning content. Traditionally, content was considered as several hour chunk, however Learning Objects can be considered as much smaller units of learning, typically ranging from 2 minutes to 15 minutes." Which is better suited for the busy practitioner[5]

The finery of Learning objects is that they may be tagged with meta-data so that lecturers can easily identify and locate specific learning objects, (associated with their sound, video and audio), according to their specific lecture requirements, on a Web-based environment. This is ideal for the proposed conceptual framework, as it enables lecturers to design and build courses quickly and place the course material on the web so they can be easily identified and accessed globally. Thus the practitioner is provided with an autonomous structure.[6]

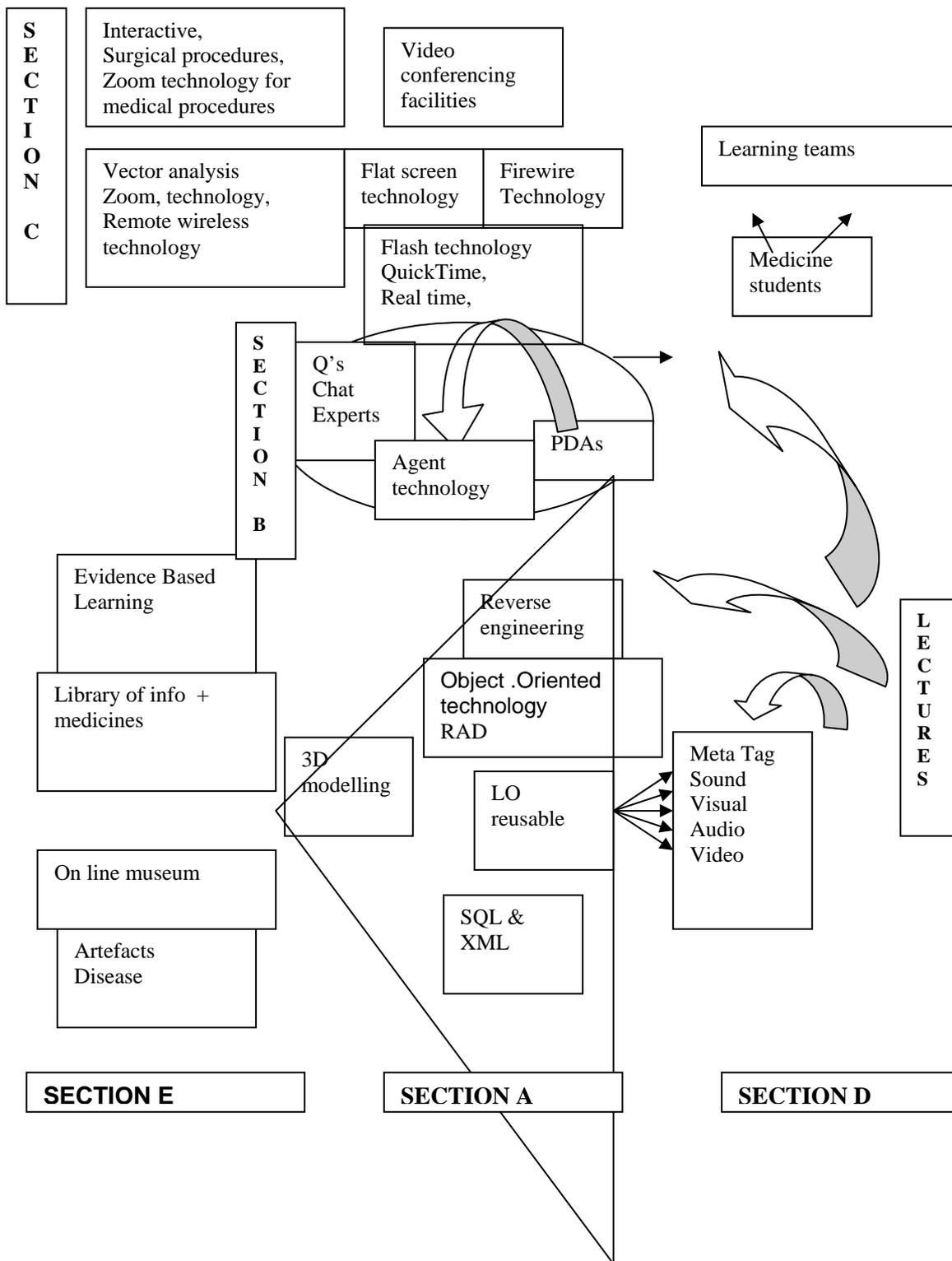
The paper further proposes that learning objects are ideal educational building blocks since the potency of Learning objects for distant EBL learning is that they are *accessibility*: in that they will be tagged with metadata so that it can be stored and referenced in a database, they are also *Reusable* in that once created, a Learning objects functions in different instructional contexts and finally they are *Interoperability*: the Learning objects are independent of both the delivery media and knowledge management systems, which means that lectures can be customised to specific applied research programme [7]

The ethos of OEBJIRLO

The foregoing has outlined the educational, industrial, and learning background that has formed the new philosophy of distant-based, on-line evidence based learning customised or accredited courses via the Internet using learning objects

paradigm. These concepts are all subsumed within what we have termed the Object oriented approach to Evidence Based learning, Just-in-time, via Internet sustained by Reusable Learning Objects (The OEBJIRLO Progression). An outline of this is shown in diagram 1 (The OEBJIRLO Progression).

Diagram 1 The OEBJIRLO Conceptual Framework



Teaching Model

Section D is the foundation block of the (conceptual framework) teaching model. And the structure is modelled on the STOEBLN conceptual framework [22]. This model gives rise to the realisation of evidence based learning via the Internet, established on the concept of reusable learning objects. These learning objects, along with their metadata are formulated into a repository, which can be easily searched [9] (Section E). This repository, which can be accessed anywhere in the world, can be used- to customise lectures, specific to the students requirements, A customised lecture can be created by picking up a Learning objects and its associated met tag, this could be a surgical procedure on video technology for example, and the same Learning objects can be used, as part of another lecture on another concept to EBL. This reusability ensures that this design formulation enables uniformity of equality across the teaching environment.

Technologies to facilitate distant learning for evidence based learning

Running alongside and finely balanced with the foundation structure is the dominant tool for online education namely the Personal Access Device (PAD) technology. Which is emphasised in Section B This is an ideal tool for practitioners as it is lightweight and easily folding, it further combines the functions of a book, notebook, and pen. This lightweight ness is further complemented by touch screen functions and high speed [8] wireless internet access, which allows learning from any environment, be it remote or from an office or home environment. Future PAD will have high-resolution screen, which will deliver easy-to-read text, video and multimedia [10]. A further advantage of the PAD is that it recognizes handwriting [11] and can accept input via a touch-screen keyboard it also accepts voice commands [12], which is more practical for practitioners working in remotes areas. The use of PADs in education will have two major consequences. Education will become truly personal, and it will become truly portable. Personal, because the PAD will serve as an individual student's primary educational tool. And portable, because PADs are portable

Flash technology and web based interconnectivity technology is used to complement this learning mechanism. (Section C). The power basis, in the wake of, the user-friendly interface is Macromedia Flash. This interface allows instantaneous and vibrant animation in addition to the rapid retrieval of information, which has not been possible till now. It is further complemented by vector based technology which enables video conferencing facilities and enhanced zoom based technology, which gives rise to the viewing of revolutionary enlightening surgical procedures, to be displayed anywhere in the world, thus permitting the manifestation of distant learning for evidence based learning.

Object Oriented Design

Furthermore, the OEBJIRLO structure supports, envelopes and perpetuates the concept of Object Oriented approach (Section A). This is needed in order to delve more deeply into the construction and organization of learning objects. The idea behind object-oriented design is that prototypical entities are defined, which are then cloned and used by a piece of software as needed. [13]. These concepts of classes, objects, and inheritance are viewed as extremely important as they form the basis of object-oriented languages such as Java, these are the new generation of languages supporting Internet based applications. The underlining technology of 3D modelling will

enable remote practitioners to view the artefacts in a museum or in a school of medicine and any further detail may be obtained by using reverse engineering to drill down or zoom into the relevant section, This is facilitated by Rapid Application Design (RAD) which allows software engineers to develop products more quickly and of higher quality. [13]

The Learning Environment

The OEBJIRLO methodological approach promotes two types of structures; tailor-made customised courses and Accredited courses. Students enter from a wide range of educational and experiential backgrounds, and may enter programmes of study within a modular framework at differing entry points. New teaching methods such as Live and recorded video conferences, on-line surgical procedures, Flash internet connectivity technology which draw on the multi-media skills, knowledge based resources which enable frequently based question (faq) and web based searching technology, supplement conventional modes of delivery. In addition to such sophisticated multi media channels entire lectures, tutorial and assessment format and schedule as well as the reading material, are assembled on-line. Such methods also emphasise student responsibility for learning and incorporate diverse activity-based learning experiences. Off the shelf virtual learning environments can incorporate such activities eg WebCT™ [14] and Blackboard™ [15] but the OEBJIRLO methodological approach is different and may well encompass the use of such environments.

Furthermore the structure supports the findings of educational study for CPD in dentistry, whereby the use of screen elements in different teaching scenarios was evaluated. Three elements such as web casting, text/image and an interactive area such as a chat box were preferred for screen viewing [16]. This is being further exploited, in dentistry, whereby the use of the Internet with web casting is being evaluated as part of a European Educational Social Fund Programme (ESF) providing up-to-date CPD for 100 dental practices and pharmacies (<http://www.kcl.ac.uk/eucpd>).

Agent Technology

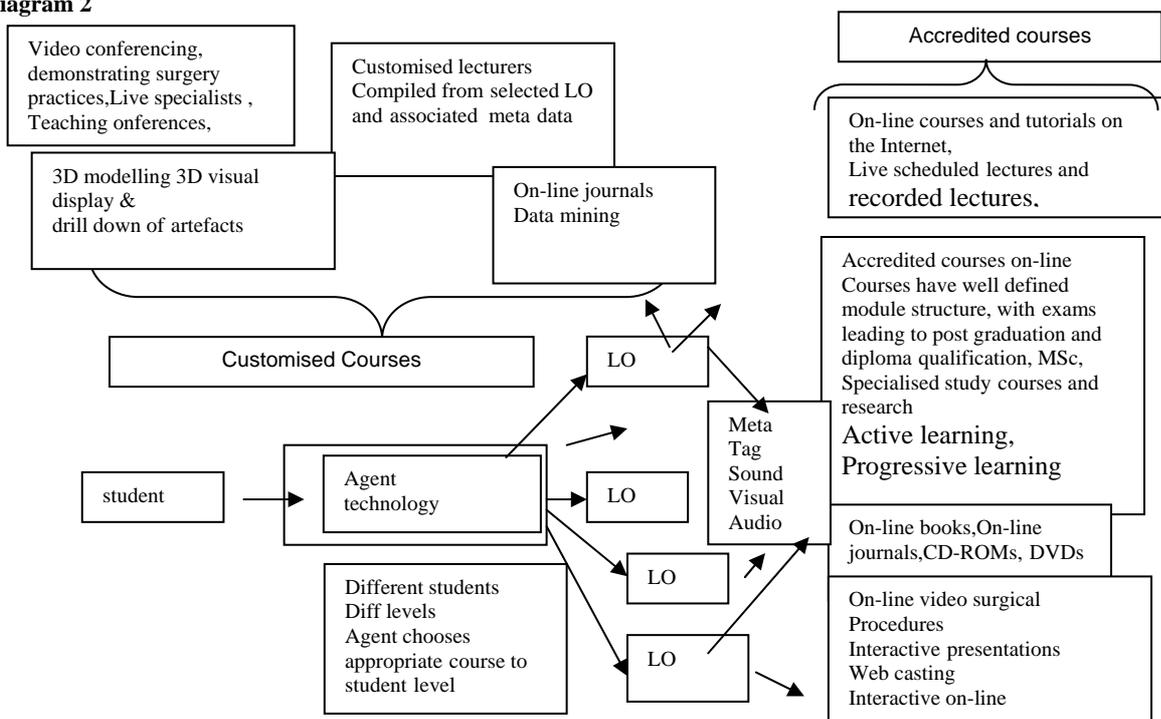
The OEBJIRLO framework also encourages agent technology phenomenon. This power base will analyse the student's requirements and it will run a methodology, which will establish what level the student should be entering the courses at, be it advanced, intermediate or beginner. The agent intelligence base will then devise an appropriate course for the student. Diagram 2 unfolds to reveal the pillars, which are subsumed in the evidence based learning via the Internet theme. This realisation of this facility has been accomplished by wireless and web-casting technology.

Data Mining

Data mining is the process of extracting information from large, complex sets of data. The OEBJIRLO approach, in addition to searching journals on-line, expand to include the concept of an online database of journal articles which might be data-mined to find relationships between articles. If a practitioner is searching for a particular article, the database can suggest similar articles that might be of interest. Given the vast resource that the Internet constitutes, such aids and pathways will become increasingly important for finding relevant information. Data mining may also be useful in developing personalised interfaces. For example, certain patterns of online behaviour might demonstrate a preference for the way in which information is presented, for example some practitioner may prefer more visual navigation tools and others text-based, hierarchical ones. Similarly, preferences for different types of

learning material might be evidence of a preferred learning style. Systems could then automatically adjust the material they present to be in the preferred style of that practitioner or select material from a database that matches their preference. These learning materials themselves may be linked by information gained from data mining, so the system will present sets of material that have been found to go together. In this way it may be that each student receives a different version of a course, based on his or her individual needs and preferences, and this course is created dynamically. [17]

Diagram 2



Meditutor and The Gordon Museum

The success of the OEBJIRLO structure is endorsed and manifested in the Meditutor case study. It is a case study, which has proven to be a pioneering educational tool, that enables professions to complete specialised training via the Internet, listens to live conferences, ask FAQ to experts in the field, obtain course material.

It further integrates the classic text based training methods with interactive on-line learning thus enabling professionals to complete specialised areas of study at a time to suit them during their busy working day. <http://www.flash.co.uk/meditutor/> This paper proposes the expansion of the Meditutor case study to put on line artefacts from medical museums such as the Gordon Museum. Such museums have artefacts which can be of immense teaching value to students in other parts of the world The Gordon Museum has a number of important historic collections. The Joseph Towne Anatomical and Dermatological wax model collections, and artefact collections of Hodgkin, Addison, Bright and Astley Cooper. All these are on permanent display throughout the Gordon Museum and available to students to study. The OEBJIRLO conceptual framework proposes the artefacts are created of 3D modelling technological images that can be zoomed down for detail inspection, so students in other parts of the world can use these pathological specimen collections as teaching objects. [18]

The Delivery Method

The OEBJIRLO methodology has responded to the changing Educational Environment by suggesting the adoption of a 'modular' approach to -structuring *accredited* programmes of study. The relative merits of modularisation may be the subject of much debate, and Pollard offers a summary of the principal advantages and disadvantages [19]. The need to deliver modules to what might be termed 'direct customers' has been accompanied by a greater emphasis on servicing 'customers' on *customised* programmes of study. These are also modular courses, but unlike the accredited programmes, they will be tailor made to the student by the Agent software, according to their requirements and the stage of their learning. For both the accredited and customised approach, the concepts of learning objects pertain to the modular approach

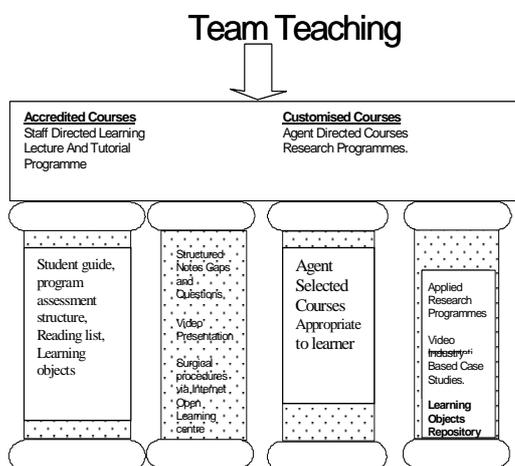
The basis of delivery for the modules is illustrated in diagram 3 (Support for Module Teaching Programmes). Each module is delivered using pre-prepared common teaching material, linked and sustained by four pillars, which rest on the OEBJIRLO foundation. A variety of teaching material has been prepared to support students. This includes discussing several case studies via the chat rooms, watching video presentations and web based presentations, surgical presentations via Internet.

For the accredited courses each module is described in a student guide which details lecture programme, web based on-line conference tutorial topics, reading lists and assessment timings,

using conference software such as WebCT or Firstclass. A lead lecture is given by video conferencing to expound principal themes, is followed up with individual study and research programmes. On-line chat rooms enable students to discuss modules topics and cases. A variety of teaching material has been prepared to support students. This material has been compiled using proven material that draws on staff experience and research in industry i.e. Burden and Cherrington (1995).

A body of structured teaching material has been developed to minimise duplication of content and to provide a common platform for delivery. This incorporates a range of techniques developed from Open Learning and Distance Learning models, such as gapped handouts, and developmental questions consolidated within the text. [20] gives a full description of such techniques. The particular problems of those students beginning their studies at differing entry points, and students who require extra support are recognised. These specific requirements are supported by the provision of computer-based training packages, which draw on the multi-media skills, knowledge, and resources.

Diagram 3



Conclusion

This paper proposes structure and approach, which moves beyond anecdotal and non-systematic experience towards techniques, which are accurate, safe and efficacious as possible. The OEBJIRLO phenomenon provides a means by which EBP can adopt a methodological approach to health care problems, rather than relying on intelligent guesswork, outdated texts or local expert opinion.

Our work reflects concern with technology transfer and evidence based learning issues in global environment. This is rooted in the concept of object oriented approach model based on learning objects formulation and Data mining sustained by the pillars of agent technology. In turn, these serve to reflect the points of contact between the medical or dental practitioner and course modules and those modules, which are directed towards post-graduate accredited skills and knowledge. Again, the integrative aspect of life long learning for the clinician (CPD) and ultimately for the patient in terms of valid patient information.

The OEBJIRLO conceptual framework and the object model fuelling the distant learning evidence based marketplace, is seen as a key tool for providing medical and dental practitioners and their complementary professions, the means by which they can maintain their professional skills.

The further development of this framework will be enhanced by future educational and technical evaluative studies in the field

by a multidisciplinary team including industrial, healthcare CPD providers and ICT educational experts.

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