

DEVELOPMENT AND IMPLEMENTATION OF A BIOINFORMATICS ONLINE DISTANCE EDUCATION LEARNING TOOL FOR AFRICA

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ABSTRACT

Bioinformatics refers to the creation and advancement of algorithms, computational and statistical techniques and theories for solving formal and practical problems arising from the management and analysis of biological data. However, some parts of the African continent have not been properly sensitized to bio-scientific and computing field. Thus, there is the need for appropriate strategies of introducing the basic components of this emerging scientific field to part of the African populace through the development of an online distance education learning tool. This study involved the design of a bioinformatics online distance educative tool an implementation of the bioinformatics online distance educative tool by a programming approach. Design and implementation were done using the Borland Delphi 7 Enterprise edition within its Integrated Development Environment. The advantage of using Delphi programming language in implementing this useful bioinformatics web tool is that Delphi programming language is an object oriented programming language that has a lot of extra facilities for the enhancement of further technical functions, which ordinary HTML cannot handle. The development and use of a bioinformatics distance education software, as a teaching tool, in some African countries holds great promise for accommodating the needs of the populace, who live in cities, small towns and remote areas.

Keywords: Bioinformatics, online distance learning tool, development, implementation

INTRODUCTION

Computational Biology and Bioinformatics are terms for an interdisciplinary field linking information technology and biology that has skyrocketed in recent years. The field is located at the interface between the two scientific and technological disciplines that can be argued to drive a significant if not the dominating part of contemporary innovation (Lengauer, 2000). Thus, Bioinformatics is an innovative field in the Sciences.

However, some parts of the African continent have not been properly introduced and sensitized to this interesting bio-scientific and computing field; the awareness and impact of bioinformatics education and its numerous benefits to the African economy have not been fully realized. The purpose of this research is to develop and implement an online distance learning web application tool for bioinformatics distance education in the African continent with computing techniques. This research will be instrumental to highlighting the numerous applications and benefits of bioinformatics to various sectors of the African economy. It will also serve as an important online distance learning tool for providing useful insights to upcoming scientists on the different research interests and areas in bioinformatics.

MATERIALS AND METHODS

Review of relevant literatures: Bioinformatics and computational biology involve the use or development of techniques including applied mathematics, informatics, statistics, computer science, artificial intelligence, chemistry, and biochemistry to solve biological problems usually at the molecular level. Bioinformatics more properly, refers to the creation and advancement of algorithms, computational and statistical techniques, and theory to solve formal and practical problems arising from the management and analysis of biological data (Achuthsankar, 2007; Aluru, 2006; Baldi *et al.*, 2001). Open learning is resource-based learning designed for individual use without the presence of a teacher. This learning can occur on campus and off-campus settings, and in full-time and part-time study.

Distance learning, however, refers to situation where the learner and teacher are geographically far apart. This could be relaying a lecture in one location to a number of other sites (DFID, 2008).

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Open and distance learning is often seen as the answer to expanding access to education and lifelong learning.

In the technologically advanced world, the effectiveness of the internet and web-based distance learning has increased in concert with its increased popularity. It has been argued that, internet based courses best serve independent and self confident students who do not feel that they are in serious need of intense interaction with tutors or lecturers when they go about their learning (Katz, 2002). Nevertheless, online courses are getting popular among other sections of the society such as homemakers, full time employees and busy parents, who cannot afford to attend live classes. The internet can offer the online learning process a variety of benefits, including easy access to educational content, interaction, a cooperative learning process and the reuse of content (Fuks, 2002). It is safe to say that, distance learning is an educational approach that integrates technology, connectivity, curricular content, and human resources (Wilson, 2002).

Bioinformatics distance learning will equally serve as an educational approach in informing and teaching some African countries that are less aware of its relevance and applications, the needed information that will enable the transformation of the educational and agricultural sectors of such countries.

One of the major problems confronting some African countries is lack of proper awareness about new, productive and innovative research fields. This problem has had its effects mostly on the agricultural and educational sectors. Part of this problem can be solved by introducing online distance learning tools on innovative research fields like bioinformatics. Thus, the need for a suitable implementation strategy cannot be underestimated. Bioinformatics online distance learning education tool is important because of the following reasons:

- (i) Bioinformatics has been experiencing a very rapid growth since the past few years
- (ii) There is serious shortage of manpower in this field
- (iii) Bioinformatics is a rapidly evolving field (Ping, 2003).
- (iv) Many African scientists do not have the fundamental knowledge on bioinformatics.
- (v) Many not aware of the immense economic benefits that bioinformatics could offer.
- (vi) Introducing a web application tool on bioinformatics online distance learning will help to adequately provide the fundamental knowledge required for college students which will help them prepare to pursue a good career in bioinformatics.
- (vii) Few universities in Africa offer bioinformatics as a discipline or engage in thorough and active research in bioinformatics. One such university is Covenant University Ota, Nigeria and few other universities in South Africa.
- (viii) Bioinformatics online distance education offers other benefits as well. It can effectively disseminate fundamental knowledge to those learners who have been denied access to classrooms. For example, women who are unable to attend traditional educational programs because of household responsibilities or cultural constraints provided they know how to read and have access to the internet.

The objectives of the research are to develop a bioinformatics online distance learning application. This application will be useful in educating both students and parents about this innovative field and its various applications to the African economy, especially the education and agricultural sector. One of the major benefits of the proposed bioinformatics online distance learning education tool is that it will be a freely functional tool without charging people school fees. Thus, it will provide basic information about bioinformatics and its applications for interested users free of charge.

Another very important benefit of this type of online distance educational tool is that, it will attract greater access. Distance education programs can increase educational access by reaching out to four commonly excluded groups. These are secondary school graduates who are preparing to gain admission to the university, married women with household responsibilities, geographically isolated students, and economically disadvantaged communities (provided that they have Internet access facilities). Of these, the largest and most rapidly growing group is composed of secondary graduates who were successful in their secondary school certificate exams but yet to receive the results of their tertiary entrance exams. Low tertiary enrollment rates mean high levels of exclusion (William Saint, 1999). So, the tool will provide greater access to majority of the populace. It will act as a means of introducing and re-orientating people to the new areas of research in the field of bioinformatics and biotechnology which can be very instrumental in boosting the agricultural products of African countries.

Methodology: The research methods employed in this study include the following:

- (i) Design of the bioinformatics online distance educative tool.
- (ii) Implementation of the bioinformatics online distance educative tool by a programming approach.

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Design and implementation were done using the Borland Delphi 7 Enterprise edition within its Integrated Development Environment (Figure I).

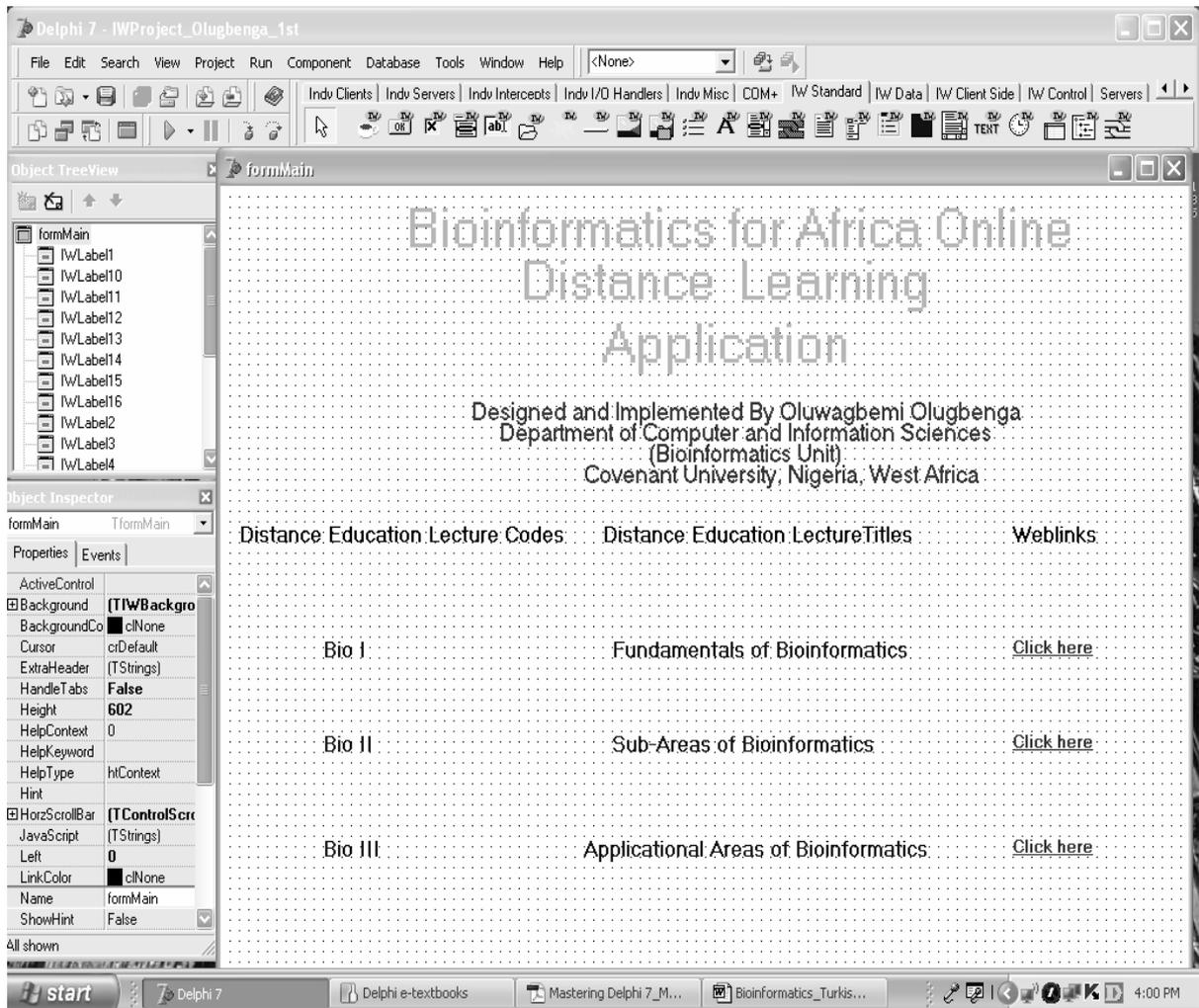


Figure I: Design phase using Borland Delphi 7

Some of the Borland Delphi 7 programming codes for the implementation is shown below:

```
Program IWProject_Olugbenga_1st;
{PUBDIST}
```

uses

```
  IWInitStandAlone,
  ServerController in 'ServerController.pas' {IWServerController: TDataModule},
  Olugbenga_1st in 'Olugbenga_1st.pas' {formMain: TIWForm1},
  DatamoduleUnit in 'DatamoduleUnit.pas' {DataModule1: TDataModule};
```

```
{$R *.res}
```

```
begin
```

```
  IWRun(TFormMain, TIWServerController);
```

```
end.
```

```
unit Olugbenga_1st;
```

```
{PUBDIST}
```

```
interface
```

```
uses
```

```
  IWAppForm, IWApplication, IWTypes, Classes, Controls, IWControl,
  IWCompLabel, IWHTMLControls;
```

```
type
  TFormMain = class(TIWebForm)
    IWebLabel1: TIWebLabel;
    IWebLabel2: TIWebLabel;
    IWebLabel3: TIWebLabel;
    IWebLabel4: TIWebLabel;
    IWebLabel5: TIWebLabel;
    IWebLabel6: TIWebLabel;
    IWebLabel7: TIWebLabel;
    IWebLabel8: TIWebLabel;
    IWebLabel9: TIWebLabel;
    IWebLabel10: TIWebLabel;
    IWebLabel11: TIWebLabel;
    IWebLabel12: TIWebLabel;
    IWebLabel13: TIWebLabel;
    IWebLabel14: TIWebLabel;
    IWebLabel15: TIWebLabel;
    IWebURL1: TIWebURL;
    IWebURL2: TIWebURL;
    IWebURL3: TIWebURL;
    IWebLabel16: TIWebLabel;
    procedure IWebFormCreate(Sender: TObject);
  public
  end;

implementation
{$R *.dfm}

uses
  ServerController;
procedure TFormMain.IWebFormCreate(Sender: TObject);
var
  //i,j: Integer;
  link1: TIWebURL;
begin
  link1 := TIWebURL.Create(Self);
  link1.Text := 'Click here';
  link1.URL := 'http://www.bioplanet.com/whatis.html';
  IWebURL1 := link1;
end;
end.
```

RESULTS AND DISCUSSION

The results of this implementation show the output of the programming aspect of this research work. Figure I shows the design phase of this research and development work. Figure II shows the results during the compilation phase of the program, which showed that this program was actually compiled before the final phase. Figure IV shows the display of the home page of the Bioinformatics web application tool. The advantage of using Delphi programming language in implementing this useful bioinformatics web tool is that Delphi programming language is an object oriented programming language that has a lot of extra facilities for the enhancement of further technical functions, which ordinary HTML cannot handle. Figure V shows part of the fundamental aspect of the learning process of the use of this tool.

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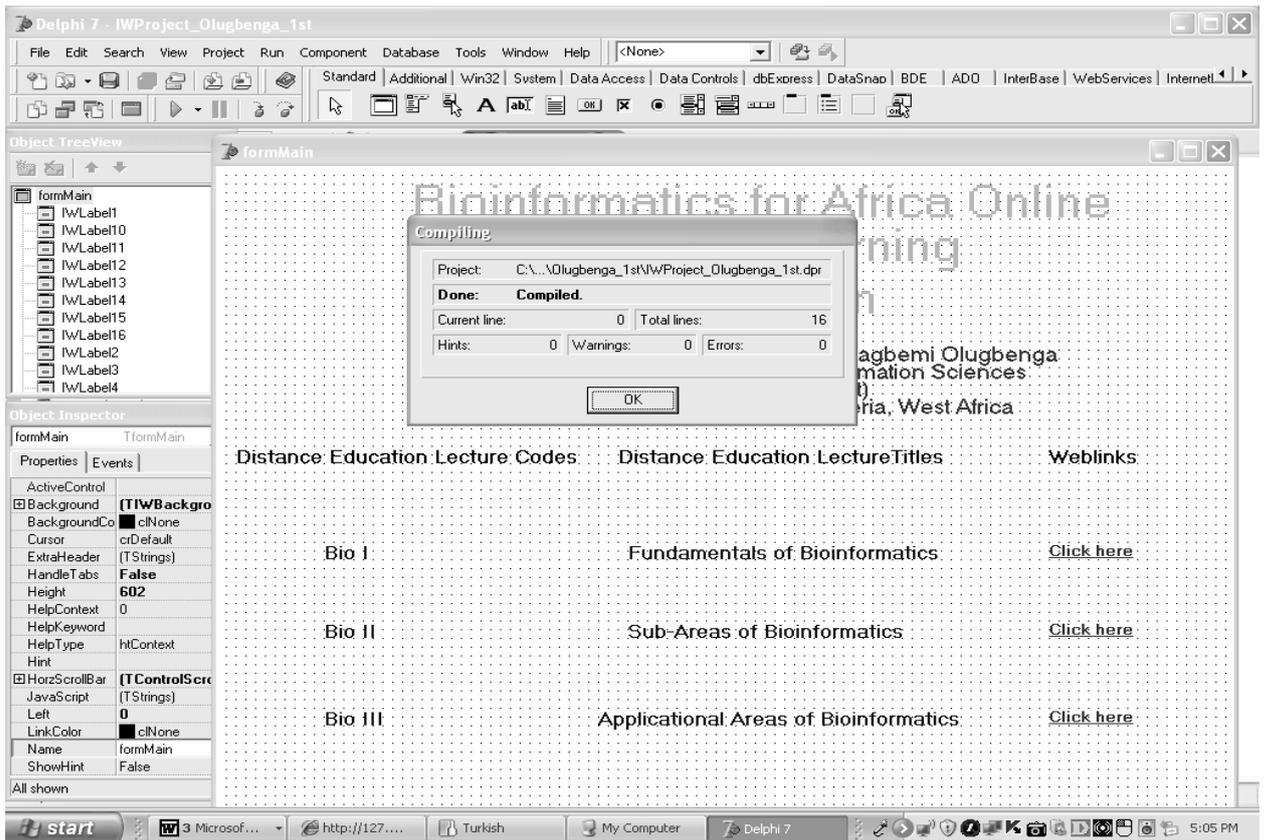


Figure II: Results during the compilation phase

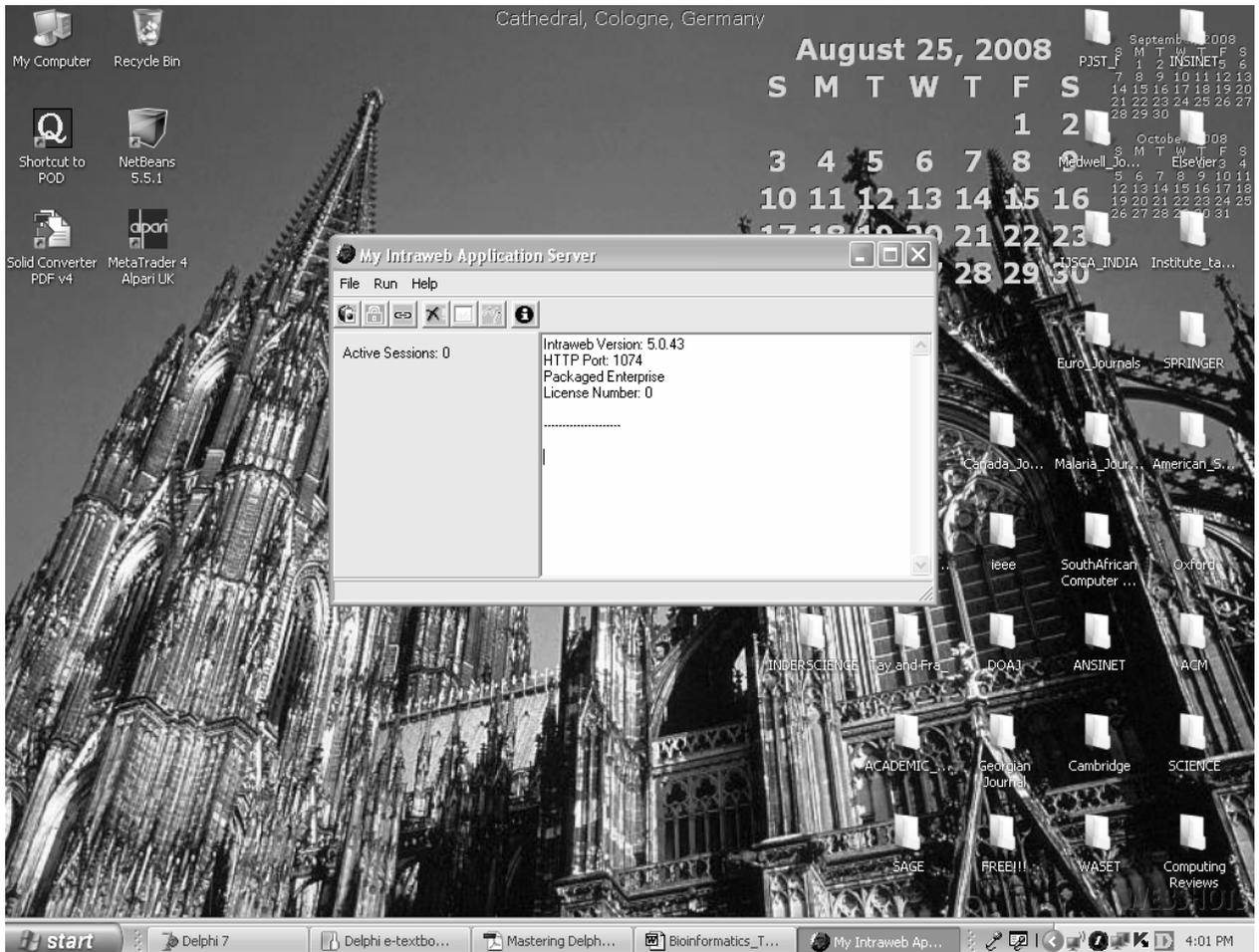


Figure III: Preliminary results during the running phase

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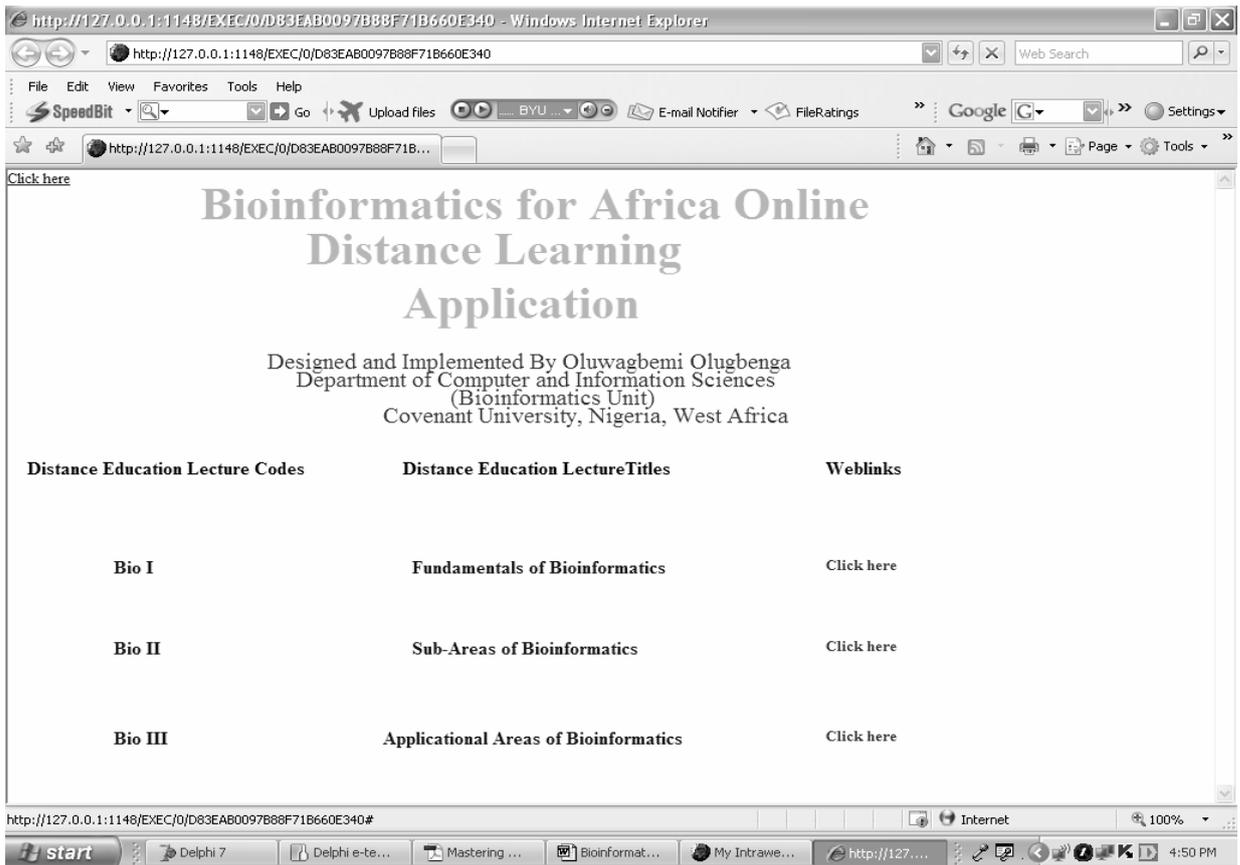


Figure IV: Generation of the web application

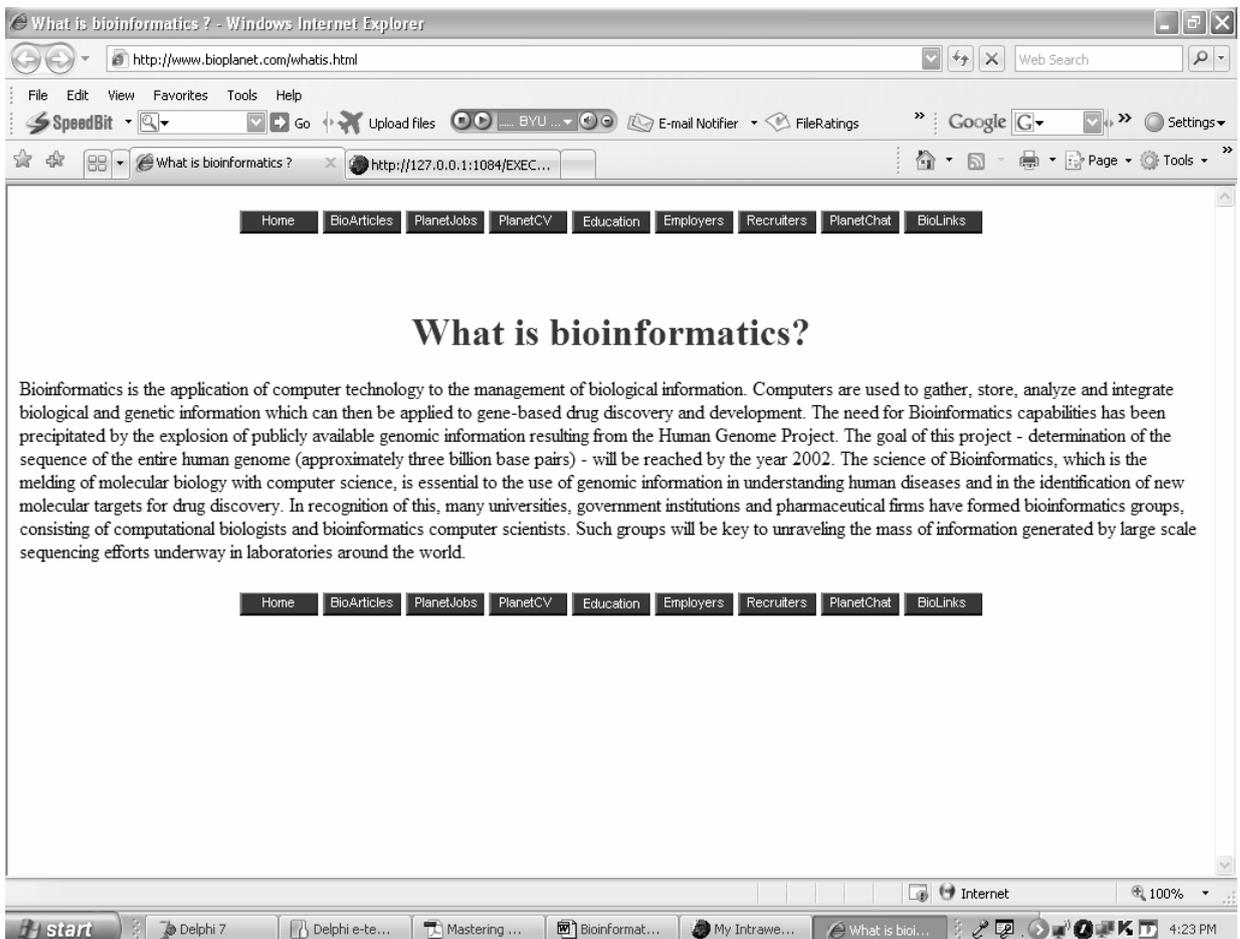


Figure V: Part of the fundamental aspect of the learning process

CONCLUSION

In conclusion, in our fast changing world, web-based distance learning is becoming progressively more popular. Online distance education is one of the technologically enhanced ways to teach and train people who choose not to breach their professional, family and personal responsibilities through attendance of traditional, face-to-face classes.

The development and use of a bioinformatics distance education software, as a teaching tool, in some African countries holds great promise for accommodating the needs of the populace who live in cities, small towns and remote areas. The advent of the Internet will provide the opportunity to reach remote and inaccessible locations. The more educated and skilled professionals we produce, the faster we can develop our economy.

REFERENCES

- Achuthsankar, S. N. (2007). Computational biology and bioinformatics - A general overview. Communications of Computer Society of India.
- DFID (2008). Practice paper, Open and distance learning, Briefing. DFID, Canada.
- Aluru, S. (Ed.) (2006). Handbook of computational molecular biology. Chapman and Hall/CRC, Computer and Information Science Series.
- Baldi, P. and Brunak, S. (2001). Bioinformatics: The machine learning approach, 2nd edition. MIT Press. Massachusetts, USA.
- Fuks, H. (2002). The development and application of distance learning courses on the internet. *Open Learning*, 17: 23-38.
- Wilson, J. (2002). The power of distance learning guest editorial. *Education*, 122(4): 638.
- Ping, L. Y. (2003). A global experiment in bioinformatics distance education. Star Course Coordinator, Department of Biological Sciences, National University of Singapore.
- Lengauer, T. (2000). Bioinformatics: From the Pre-genomic to the Post-genomic. *European Research Consortium for Informatics and Mathematics News*, No. 43, www.ercim.org
- William S. (1999). Tertiary distance education and technology in Sub-Saharan Africa, Working Group on Higher Education Association for the Development of Education in Africa. The World Bank, Washington DC.
- Katz, Y. J. (2002). Attitudes Affecting College Students' Preferences for Distance Learning. *Journal of Computer Assisted Learning*, 18: 2-9.