

**Determining the Effectiveness of Web Based
Learning in Sport**

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Abstract

As sports training becomes more scientific in its methods it is important that sports fully utilize and embrace the major changes happening in the Web 2.0 world of user generated content, interactivity, social networks, mobile devices such as smart phones and tablets with video taking and sharing capabilities and pervasive high speed fixed and mobile bandwidth. It is important to understand and quantify the effect these Web 2.0 capabilities have on the world of sports training. A search through the literature from the age of Computer Based Instruction (CBI) to the present day showed no significant prior art in this exact area of measuring the effectiveness of web based training in sport, however there is a significant body of work discussing the effectiveness of Web / Computer based learning in an academic / conventional classroom context. These studies showed that there is a significant and measurable benefit in using Web / Computer based instruction in these contexts. In this study a combination of qualitative and quantitative methods were used to investigate whether this measurable benefit can be replicated in the sports learning context. A questionnaire was used at the beginning for all participants, followed by an assessment using the International Tennis Federations (ITF) International Tennis Number (ITN) system conducted by a qualified independent tennis coach. Then the evaluated subjects were broken into two groups; one group (Hybrid Group), receiving face-to-face coaching and web-based learning and a second group (Web Only Group), receiving web-based learning only. A specific web-based learning environment was developed as a tool to test the impact of the technologies used by subjects on their learning. The subjects in all groups then re-took the assessment and completed a feedback form. The results were meaningful. Overall there was an improvement in performance from ITN assessment one to ITN assessment two of 35%. These results when broken down into the two groups showed that the Hybrid Group had a 39% improvement in performance and the Web Only group had a 30% improvement in performance.

Attestation

I hereby certify that this material, which I now submit for assessment of the programme of study leading to the award of Master of Science in Web Technologies is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

Signature

Date

Acknowledgements

I would like to thank my family, especially my wife Samantha for supporting me and putting up with me for the last 18 months. Without their support, patience and encouragement I would not have made it.

Definitions

eLearning: eLearning in the context of this research is defined as the use of all forms of electronically supported learning and teaching.

Web 2.0: What is meant in this paper by Web 2.0 is the ability of web pages to be interactive, collaborative and have user generated content.

Blended Learning: eLearning delivered in conjunction with classroom learning

Abbreviations

CBT: Computer Based Training

CBL: Computer Based Learning

CBI: Computer Based Instruction

WBT: Web Based Training

WBL: Web Based Learning

ITF: International Tennis Federation

ITN: International Tennis Number

LMS: Learning Management System

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Introduction

1.1 Background and Context

Learning via computers has been around since the 1960's. It started with basic training on mainframes, then moved to microcomputers, PC's and more recently via the web browser from any suitable internet enabled device. In the context of this study web-based learning will mean learning over a broadband connection whether fixed or mobile and delivered using any web browser. Most of the research in the area of learning via technology based instruction has been focused on academia and how Computer Based Instruction (CBI) can enhance or even replace conventional classroom training. As you will see from the Literature review there is a body of evidence from significant previous research that Computer Based Instruction (CBI) and to a lesser extent Web Based Instruction (WBI) is proven effective in enhancing classroom learning and sometimes even replacing it.

The benefits of learning via technology are well established. In 1991 (Kulik and Kulik 1991) carried out a study analysing 254 other studies that had been done previously in this area to come up with the finding that illustrated the reduction of time it takes to impart knowledge. This seems to consistently come out at around a time saving of 30+% over traditional methods. Furthermore (Fletcher 2001) established the rule of "thirds", which shows that CBI reduces the cost of instruction by about one third, and additionally either reduces the time of instruction by about one third or increases the effectiveness of instruction by one-third. A more recent study analysing 500 reports from 1996 to 2002 in this area was carried out by the US Army (Wisher and Olson 2003); this report suggested that "blended" learning was best, i.e., a combination of face-to-face tuition supplemented by web learning resources.

In the book *Global Networks* (Harasim 1993, p 3), predicted that "*global networks, the use of computers for international communication, will further enhance and expand how humans connect, communicate and create community*". Now that we are in the Web 2.0 world that prediction is finally being realised. As (Lim, So et al. 2010) said on page 203 of their study in 2010, "*The advent of Web 2.0 technologies has opened up new possibilities for open learning that not only challenge physical boundaries to bring about a sense of globalization in education but also emphasize the collective as a social and participatory web, propelling educators to re-examine how eLearning is conducted.*". Because of Web 2.0 capabilities we are able to reach into new domains for eLearning not previously possible due to technological constraints. In this study we investigate whether the Web 2.0 world can bring the benefits proven in the academic world to the sports learning domain due to the advancements in hardware, software, networks and mobility.

In this study we empower the subjects to create their own content and share it with their coach and use web chat to interactively engage and discuss this content and its meaning. These Web 2.0 capabilities

when applying to web-based learning in sports will be a game changer and move us to a new age in effective and quantifiable eLearning in the sports domain.

Whilst there is a significant body of work illustrating the advantages of Computer Based Instruction and Web Based Learning in academia there is very little if any research that can be found in regards to the effectiveness of Web Based Learning in Sport. A search of ERIC was undertaken and no suitable studies were found. The primary goal of this research is to ascertain if the results achieved in academia for Computer Based Instruction and Web Based Learning can be replicated in sport. The sport that will be used during this research is Tennis. The reason that Tennis was chosen is that there is an internationally recognised standard for grading tennis players that gives a quantifiable number as to the proficiency of a tennis player. The standard was created by the International Tennis Federation and is called the International Tennis Number (ITF 2012). The other reason that tennis was chosen is that tennis is a very expensive sport to learn to play properly and because of this there is a barrier to entry for people of limited means. If this research can prove that Web Based Learning is an effective tool for learning the game of tennis then it will open up the sport to a whole new demographic. Also if this can be done for Tennis then there is no reason why it cannot be extended to other sports like Badminton, Squash, Table Tennis, Racket Ball, and Golf etc...

1.2 Scope and Objectives

The primary goal of this project is to ascertain whether results achieved with Computer and Web based learning in academia can be replicated in sports. A secondary goal is to see how effective the two approaches taken in this study are:

- Approach 1: Learning via the web only
- Approach 2: Learning in a hybrid manner – Web and On-Court face to face tuition

The purpose of the research program was to ascertain whether web-based learning could be applied to sport as either a replacement for face-to-face tuition or a useful addition to face-to-face tuition and to measure that effectiveness. The effectiveness of the web-based learning was based around the ITF ITN number (ITF 2012). An assessment was performed at the beginning of the program and at the conclusion. All subjects had to fill out a questionnaire (see Appendix 1) at the beginning of the process and a feedback form (see Appendix 3) at the end of the process. Subjects were given access to a web-based learning tool “My Tennis World” to aid them in their tuition. This program allowed them to:

- Look at generic videos and information pertaining to tennis
- Receive their ITF ITN assessment scores
- Be assigned programs by their web-based coach
- Upload content i.e. videos of themselves for analysis and comment by the coach
- Schedule and have web-based coaching chats with a coach
- See their detailed ITN scores
- Allow coaches to share content i.e. videos with the participants

The goal of this activity was to improve their ITN score by the end of the study.

The Program commenced on the 24th November and finished on the 29th December, see Figure 1.

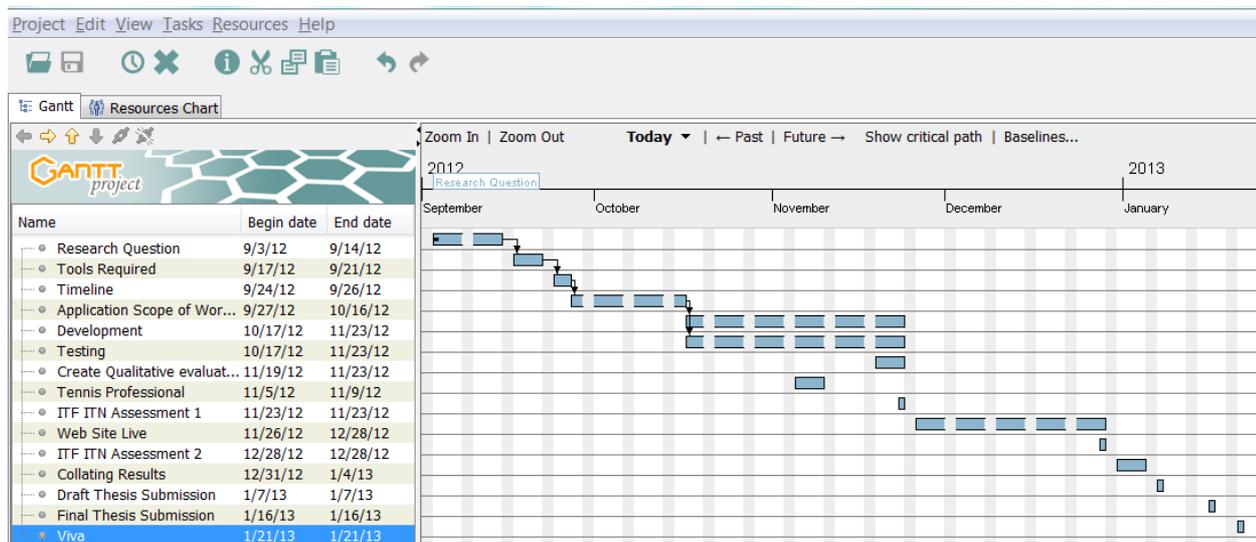


Figure 1 - Initial Project Plan

The program operated as follows:

- There were two groups
 - Group 1 (Hybrid Group) consisted of 5 participants
 - Completed questionnaire
 - Took initial assessment
 - Received training on the web-based learning tool
 - Had an initial Program with focus area assigned to them by a coach
 - Took a face-to-face coaching session once a week
 - Had coach chats
 - Looked at generic coaching content
 - Took final assessment
 - Filled out feedback form
 - Group 2 (Web Only Group)
 - Consisted of 4 participants
 - Completed questionnaire
 - Took initial assessment
 - Received training on the web-based learning tool
 - Had an initial Program and focus area assigned to them by a coach
 - Had coach chats
 - Looked at generic coaching content
 - Took final assessment
 - Filled out feedback form

1.3 Achievements

The study was broken into 4 distinct areas:

- Research Question driving the Study Goals and the eLearning tool Requirements Scope & Definition
- Creation of an eLearning tool
- Four week study program
- Analyse and draw conclusions from results

The Research Question, study goals and requirements scope & definition were agreed with the college and completed on time as per the project plan.

The creation of an eLearning tool was targeted to be completed within four weeks. This area ran over time by one week and was completed within five weeks. The application was written in Ruby on Rails using JavaScript, jQuery, HTML5 and CSS3 and deployed to the Heroku platform on 24th November 2012 and can be accessed from the following link blooming-lake-8379.herokuapp.com.

This had the knock on effect of delaying the start of the study program by one week.

The study program itself was delayed by a week; it started on 24th November 2012 and ran until 29th December 2012.

- All subjects completed their questionnaires (see Appendix 1) before the beginning of the study.
- All subjects participated in ITF ITN Assessment 1 and 2 (ITF 2012).
- Only three of the subjects were given any training on the web site. So to that end a “User Guide” (see Appendix 2) was created and distributed to all subjects.
- All subjects used the website “My Tennis World”.
- All subjects filled in the feedback form (see Appendix 3).

The results were collated, conclusions were drawn and recommendations given. Both the primary and secondary goals were met.

1.4 Overview of Dissertation

In this dissertation firstly a background is given to the subject area and what goals this study is trying to achieve, namely that the results achieved in traditional academic subjects using WBL can be replicated in the sports domain.

The dissertation then explains the full scope of works, requirements and project plan defined to achieve those goals. Section 1.3 briefly describes how successful the project was in going through the process and achieving the goals set in section 1.2.

In section 2 the Literature Review outlines the state of the art summarising the current domain knowledge and has a detailed look at what others have done in this area. It also comments on how it applied to this study.

Section 3 is a technical overview of the web application, “My Tennis World”, developed to test the research goals.

In section 4 a detailed evaluation is undertaken as to how the study was actually conducted and delivered.

Section 5 is the results section where all the raw data from the five different data sources are collated and summarized.

Finally all the previous sections are reviewed in section 6 and a conclusion is reached with some areas of concern mentioned and with recommendations for future work.

All the material referenced in this dissertation is listed in the “Reference” section followed by the appendices.

2 Literature Review

2.1 Research Question

The focus of this paper and literature review is “Determining the Effectiveness of Web-based Learning in Sport”.

2.2 Background

This literature review looks at the prior art in this domain. As no prior art on the effectiveness of web-based learning in sport could be found, observations and comparisons with the significant body of prior art that exists in academic circles in regards to WBL will be drawn upon.

This literature review will first take a look at the history of eLearning / CBI / CBT and WBL from the late 50's to the present date. It will discuss what is meant by web-based learning, blended / hybrid learning and the impact of Web 2.0 and eLearning 2.0. The literature review will then investigate the effectiveness of eLearning in the academic domain. A comparison is then done between learning in the classroom versus / CBI / CBT and WBL. Issues with eLearning are then discussed and an investigation is done on what is happening in eLearning in sport and some examples are given of some similar, but functionally lacking, sites in the tennis learning domain. The ITF ITN is the corner stone of the quantifiable research in this study and an overview is given as to what this process is and what the ratings actually mean. This papers area of contribution to research is then discussed and finally a look is taken at the some other key factors that will have a bearing on the future of eLearning such as access to the internet and the growth in smart mobility devices.

2.3 History of e-learning

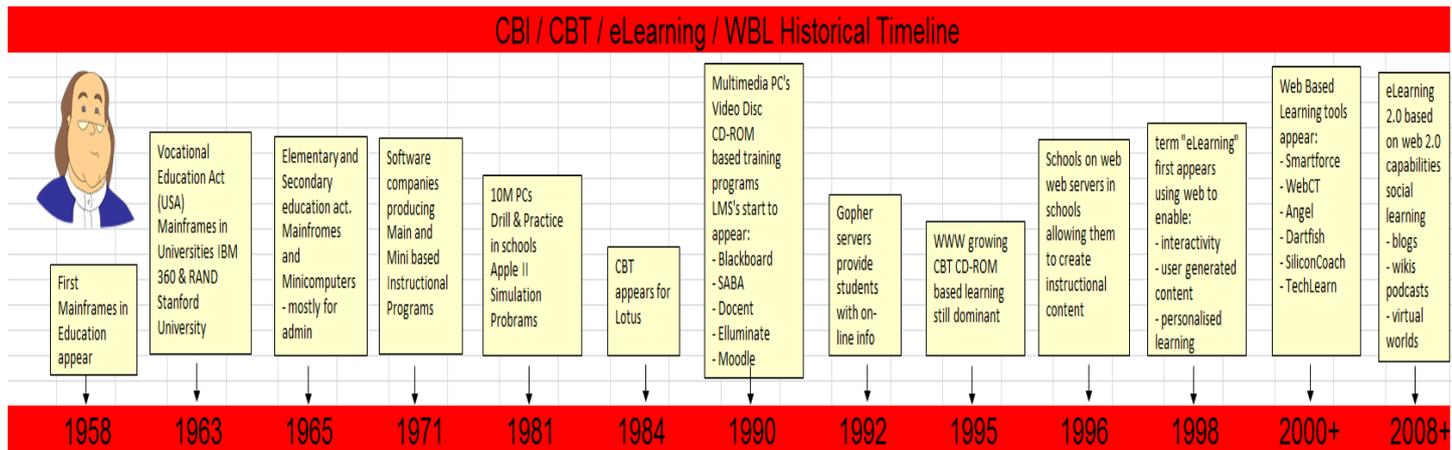


Figure 2 - History of eLearning Timeline

What we mean by eLearning is based on the constructivist learning model as defined by (Tavangarian, Leybold et al. 2004, p 274). They defined it as follows, "*We will call e-Learning all forms of electronic supported learning and teaching, which are procedural in character and aim to effect the construction of knowledge with reference to individual experience, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media (specific in the sense elaborated previously) to implement the learning process. Thus, our definition is based on the constructivist learning model. Knowledge is no artefact and thus cannot be conveyed to anyone. It must be constructed by the learner herself/himself. The paradigm of the moderate constructivism in which instruction and construction complement each other, seems to be especially appropriate for e-Learning*" (Tavangarian, Leybold et al. 2004, p 274). This is the approach that has been taken in this study where the subjects upload videos of their performance for critique and interactive discussion with their web-based coach. The subjects also interact with generic content illustrating best practice in how various aspects of tennis can be undertaken and further discuss this with their web-based coach who periodically sets them a programme with specific goals to achieve. Therefore the subject navigates an unstructured path through user generated and generic content whilst been mentored and kept focused on their goals by their web-based coach without the traditional learning constraints of time and place.

Electronic learning in some shape or form has been around since the late 50's early 60's, see Figure 2 above. Mainframes such as the IBM 360 and Rand were used in Universities such as Stanford. In 1960 PLATO (Programmed Logic for Automated Teaching Operations) was created to provide an eLearning platform for colleges and continued to be used in until 2006 (Learn-Source.com 2013). Bernard Luskin, who has a large body of work in this area, and is still active today, introduced the first computers to

community colleges for educational purposes and produced the first Data Processing curriculum. In the 70's independent software companies started producing instructional learning programs for Mainframes and Minicomputers. These first training programmes were often little more than putting existing text books and notes on-line in a linear order. They had no capability for multimedia, interactivity, collaboration or learner input. The arrival of such computing devices as the Altair 880, Apple II and the IBM PC in the late 70's enabled colleges to start teaching science and mathematics to university students (Njoo and de Jong 1991). By the 1980's the PC was starting to appear in schools. CBT tools for teaching software packages, like Bill McCabe with his Lotus CBT solution, became more commonplace. The multi-media PC and the CD-ROM appeared in the 90's and these were a game changer for CBT. They enabled a richer user experience bringing video to the desktop and the ability to take different routes through the learning process based on user decisions. The CBT solutions themselves were costly to create, but once created the replication and distribution costs of CD-ROMs due to their size was minimal. These factors created a significant growth in the range of areas used for CBT and also where CBT was actually consumed. CBT entered the consumer market and the home. The CD-ROM also enabled a number of business and academic focused LMS (Learning Management Systems) to come into being. Some were commercially available products (Blackboard, SABA and Decent) and others were open source (Elluminate, Moodle). Using these LMS's you could typically upload and download course work and assignments, share material, take tests and have some communication such as email, blogging and instant messaging.

The term eLearning itself does not appear in papers or research until the late 1990's. It first seems to have appeared in a paper on eLearning from (Cross 2004) and then at a CBT conference in Los Angeles called the "Online Learning Conference" in October 1999. (Cross 2004) talked about the "anytime anywhere" concept of learning at your own pace and place. These new eLearning capabilities were enabled by the advances in Web 2.0 functionality. eLearning also incorporates the philosophy of CSCL (Computer Supported Collaborative Learning) (Stahl, Koschmann et al. 2006). CSCL is similar to the constructivist learning model discussed earlier involving social interaction through the web and learning through the sharing and construction of knowledge via the web. Some examples of these types of eLearning WBL tools are Smartforce, WebCT, Angel, Dartfish, SiliconCoach Ltd. eLearning has continued to evolve and improve in its effectiveness up to the present date due to the improvement in Web 2.0 capabilities of user generated content, social interactivity, hardware device innovation and pervasive fixed and mobile bandwidth.

2.4 Web-Based Learning

Web-based learning is now commonplace in academia with (Diaz 2011) reporting in 2011 the usage of WBL in academic courses by the students themselves, see Figure 3 below:

Web-Based Technology Use in Courses	Percentage Using Technology	Percentage of Users Using the Technology to Collaborate in Courses
Web-based word processor, spreadsheet, presentation, and form applications (Google Docs, iWork, Microsoft Office Live Workspace, Zoho, etc.)	36.2%	53.0
Wikis (Wikipedia, course wiki, etc.)	33.1%	30.7
Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)	29.4%	49.4
College textbook resource websites (Pearson, PrenticeHall, McGraw-Hill)	26.1	23.2
Video-sharing websites (YouTube, etc.)	24.3%	33.4
Web-based calendars (Google Calendar, etc.)	17.4%	NA
Web-based citation/bibliography tools (CiteULike, OttoBib, etc.)	17.2%	16.9
Blogs	11.6%	37.6
College study support (Cramster, Turnitin, Essay Checker, ShareNotes, etc.)	10.9%	NA
Photo-sharing websites (Flickr, Snapfish, Picasa, etc.)	5.4%	32.9
Micro-blogs (Twitter, etc.)	4.3%	40.2
Online virtual worlds (Second Life, Forterra, etc.)	1.4%	29.4
Social bookmarking/tagging (Delicious, Digg, Newsvine)	2.8	30.5

Figure 3 - Usage of WBL tools in Academia

Whilst it is not surprising that WBL tools were being used it was unexpected to find that, with the exception of web-based storage tools, less than 50% of students were actively using these tools.

In a study in 2012, (McGorry 2012), talks about the growth of online learning in the last decade. The findings were that:

- 20% year on year growth in WBL courses being offered through schools
- 63% of schools said WBL was critical
- U.S. universities have over 60k WBL courses encompassing 4.6 million students

Web-based learning is now an established part of academic institutions and as we see from the McGorry study it is currently increasing at rate of 20% year on year.

WBL also now gives the ability to access “experts” in a particular area outside your learning institution or locale which would previously have not been possible. This promises significant incremental performance improvements in the future for WBL. This is particularly applicable and beneficial in the sports learning domain (Chisamore and Katz 2007).

2.5 Blended Learning

Blended learning is the combination of classroom tuition and web-based learning. A study of studies by (Wisher and Olson 2003) titled “The Effectiveness of Web-based Learning”, concluded that Blended Learning was the most effective in producing quantifiable positive results in the studies reviewed over traditional classroom learning on its own or Web-based learning on its own. In this paper it will be reported that similar findings were made which would reinforce the learning’s from the Wisner and Olson study as the blended / hybrid group reported the highest average levels of improvement, however the actual improvement over Web-Only learning was less than was anticipated and further investigation is required.

Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I was able to control the pace of my own learning.	49%	41%	8%	2%	0%
The online course materials were difficult to follow.	10%	14%	16%	25%	35%
Online assignments were helpful in understanding the course content.	33%	47%	18%	2%	0%
The time I spent online would better have been spent in class.	11%	6%	18%	18%	47%
The connection between what I did online and in class was clear.	37%	37%	20%	6%	0%
Participating in the online discussion board could be useless for my learning.	12%	20%	20%	12%	37%
I wouldn't have any difficulty managing my time for the online part of the course.	43%	28%	18%	4%	8%
I was unable to share ideas with other students on a regular basis.	12%	14%	31%	24%	20%
I would recommend taking hybrid courses to a friend.	55%	35%	8%	2%	0%

Figure 4 - Blended Learning Report

A study by (Bai and Smith 2010) investigated a course delivered in a blended manner. The results were very positive as can be seen above in Figure 4. 90% of the students surveyed would recommend taking a hybrid / blended course to their friend.

2.6 Web 2.0 / eLearning 2.0

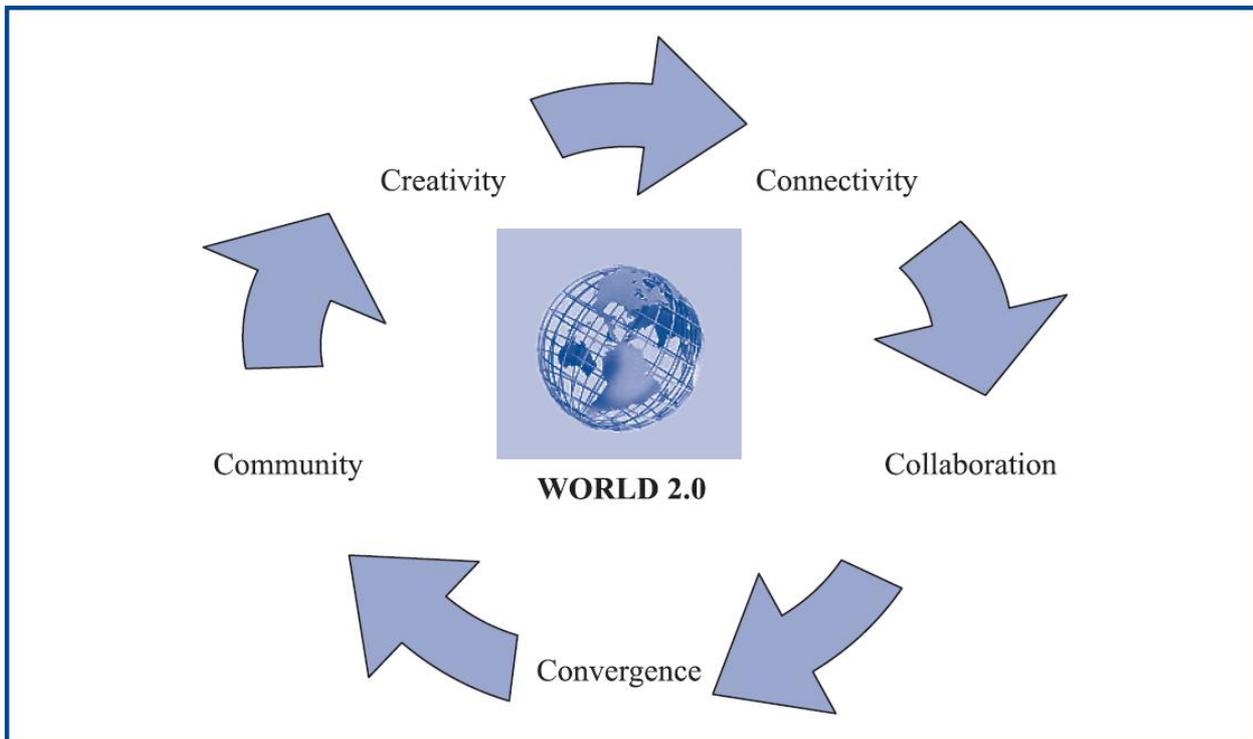


Figure 5 - Web 2.0 / eLearning 2.0 / World 2.0

Web 2.0 / eLearning 2.0 is about enabling the subject to use a web-based tool to create their own content, upload that content, have access to generic content and other subjects and tutors shared content, being able to discuss this content with their tutor and amongst themselves and all this enabled by pervasive adequate bandwidth and devices. This is the domain of “anyplace, anytime” learning.

In a study in 2009 undertaken by (Karakas 2009, p 24) Figure 5 above was created, this captures the essence of the Web 2.0 eLearning experience. This is the new way of learning and has been enabled by the Web 2.0 technologies and pervasive bandwidth. The “My Tennis World” web-based application has tried to capture all these areas by allowing users to create their own content, upload it to the website, discuss this content and the resident generic content with the coaches and create a convergent focused tennis community on one website.

Dimension	eLearning 1.0	eLearning 2.0
Technological	Closed structure	Open structure
Social	Bounded participation	Fluid participation
Epistemological	Epistemology of possession	Epistemology of practice

Figure 6 - eLearning 1.0 vs. eLearning 2.0

As we see from (Lim, So et al. 2010) 's Figure 6 from page 206 of their study above, the Web 2.0 capabilities have enabled the eLearning experience to become more adaptable and easy to change with a flexible structure and path driven by the subject rather than by the course putting the subject at the centre of a knowledge creating / usage community of peers and tutors. As they say on page 207 of their paper *“our notion of knowledge and knowing should shift from an epistemology of possession to an epistemology of practice to embrace the culture of participatory learning”* (Lim, So et al. 2010).

2.7 Effectiveness of eLearning

There are a number of aggregate studies have looked into the effectiveness of eLearning. In this section two will be reviewed:

- “*Effectiveness of Computer-based instruction: An updated analysis*” (Kulik and Kulik 1991)
- “*The Effectiveness of Web-based Learning an initial enquiry*” (Wisher and Olson 2003)

Both are in-depth studies that reviewed all the available body of prior art in this domain at their time of publishing. Hence I have chosen one from the nineties which mostly focusses on eLearning through CBI and one from the 2000’s that’s focuses on eLearning through WBL.

In the (Kulik and Kulik 1991) study in 1991 they reviewed 254 pieces of prior art in this domain. In summary they reported that:

- 81% of the studies had higher education scores for CBI students than classroom only students
- Overall there was a 30% improvement in higher education scores of CBI students over classroom only students
- Shorter duration studies (4 weeks or under) showed a more significant improvement in performance (effect size of .42)
- Longer duration studies (over 4 weeks) showed a lower effect size of only .26
- Two thirds as much instruction time was needed for CBI students than conventional classroom only students

So in the (Kulik and Kulik 1991) study it was proven that CBI was effective in an academic learning setting. There were also cost saving implications as well for this study for learning institutions as only two thirds as much instruction time was actually needed to deliver the same content when using CBI. In their study a duration effect was noted. Courses delivered in four weeks or under showed a meaningful level of improvement over courses of a longer duration. Kulik and Kulik were unsure as to the reason for this effect and mentioned that a ‘novelty effect’ could be at play where subjects actually focus more on the content in a new way of learning and this effect may dissipate over time as the ‘novelty effect’ erodes.

The (Wisher and Olson 2003) study in 2003 focused on Web-based learning. They reviewed 500 pieces of prior art, but actually focussed their research on 47 reports in higher education between 1996 and 2002 specifically on web-based learning. To properly evaluate all studies using the same metrics they defined an effect size method that described the difference between two group means divided by standard deviation (pooled or treatment group, whichever was applicable). Examples of the range of effect sizes and their implications on performance were:

- .2 small
- .5 medium
- .8 high

Their study found that:

- Web-based learning overall achieved an effect size of .32 – which would indicate a small to medium improvement in performance.
- Courses that used Web-based tutoring reported effect sizes of up to .41 – which showed close to a medium improvement in performance
- Blended courses reported an effect size of .48 - which shows a medium improvement in performance
- Large studies (100+ students) reported an effect size of .55 – which shows a medium to high level of improvement

Web-based learning was shown to be as effective as CBI had been. The study also showed that if certain other variables were present effectiveness went up. The effects of a Web-based tutor improved performance as did undertaking a course in a Blended format i.e. Classroom and WBL. However the biggest improvement was shown to be in larger studies.

The (Wisher and Olson 2003) study specifically mentioned a study by (Fletcher 2001), who in their research came up with the “Rule of Thirds”:

- eLearning reduces the cost of instruction by one-third
- reduces the time of instruction by one-third (backs up (Kulik and Kulik 1991) findings mentioned earlier)
- or;
- increases effectiveness of instruction by one-third

These findings mirror the findings in the “My Tennis World” study which showed WBL overall improvements in performance of approximately one-third.

One of the findings in the “My Tennis World” study was a high level of improvement for the focus areas in the program assigned to the subjects of the study. The focus area was given to a subject by the coach after their initial assessment as part of their program. This was a specific area of the subject’s game they had to focus on for the duration of the study and interact with the coach on. The improvements in performance in these specific focus areas on average were three times the overall level of improvement in performance. Nothing in the research above indicated that these unexpectedly high levels of performance improvement would be attained. However an explanation of these results could possibly be found in the research of (Verano 1987) and (Bloom 1984) who both reported how important interactivity is and more importantly how important one-to-one tutoring is in the learning process. They both reported improvements in performance of subjects involved in interactive one-to-one learning similar to the improvements reported in the “My Tennis World” study. Their subjects, in both cases, moved from the 50th percentile to the 98th percentile in performance. This interactive, one-to-one learning is exactly what the “My Tennis World” web application delivers to the subject. These results may lead to a new revolution in learning in general, not just eLearning, as it becomes cost effect to deliver targeted tutor led WBL to students.

In a more recent study by (Homitz and Berge 2008) they reinforce how important having web-based tutors are not only in performance improvement but in the positive perception of the course by the students when assigned web-based tutors are available to quickly assist them on their course subject matter.

In this section up to now we have discussed the effectiveness of eLearning in abstraction i.e. just looking at the results without actually looking at what makes up a good Web-based Learning tool. There are many factors that determine the effectiveness of any one Web-based learning tool such as but not limited to the items listed in the Figure 7 below:

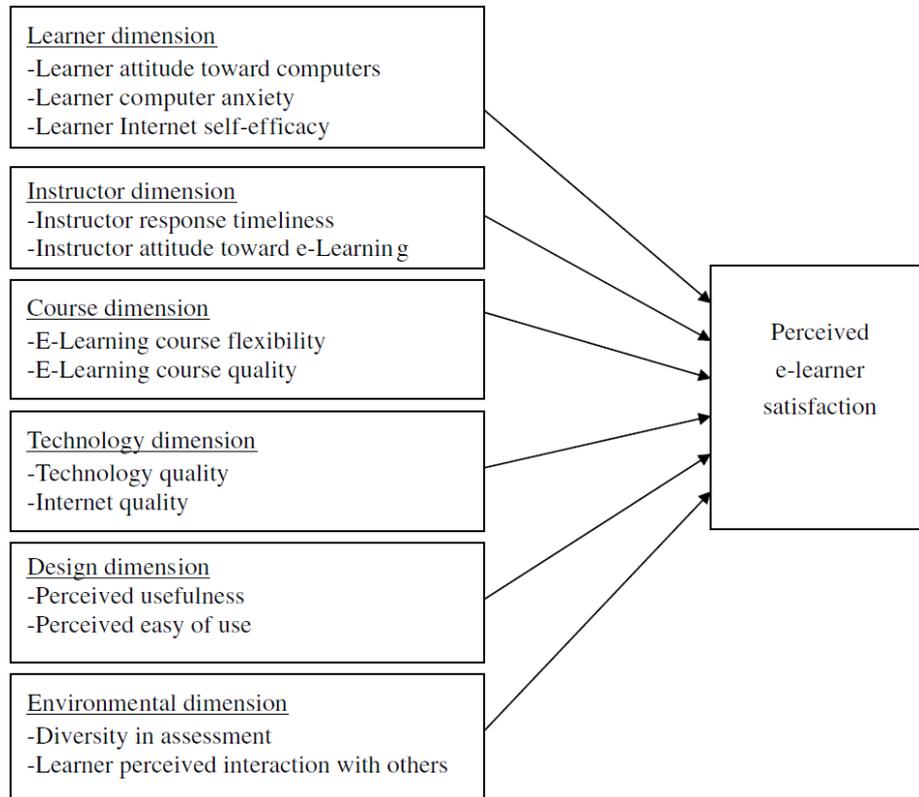


Figure 7 - Factors in the success of any WBL tool

This Figure 7, was produced by (Sun, Tsai et al. 2008) in a study in 2008 and highlights the importance of:

- Learner competencies and attitudes
- Instructor competencies, attitude and aptitude for eLearning
- Course scope, quality and applicability to be delivered via eLearning
- Technology and bandwidth quality
- Usability
- Interactivity levels and capabilities

These will be dealt with in more detail in the “Issues with eLearning” section.

2.8 Classroom vs. CBI vs. WBL

In earlier sections we have touched on the variation in effectiveness of the various methods of learning:

- Traditional Classroom
- CBI / CBT
- WBL

In this section the areas of tutoring and blended learning will be left out of the main evaluation as to some extent they apply to all three.

Table 1 - Classroom vs. CBI vs. WBL

Method	Avg Performance	Time / Cost	Easy Modification	Inter-Activity	Access	Self Pacing	Resource Sharing	Collab-oration	Expert	MM Formats
Classroom	50%	100%	No	Limited	No	No	No	Limited	No	No
CBI	62%	66%	No	Limited	Limited	Yes	No	No	No	Yes
WBL	62%	.66	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1 above, summarizes the main points of comparison between the three modes of learning. CBI and WBL on average come out a similar level of performance improvement over Classroom only learning. As Table 1 above illustrates WBL has some significant advantages over CBI that will probably only accelerate over time:

- Flexible course modification
- Broad accessibility
- Online links to related
 - Materials
 - Instructors
 - Fellow students
- Interactivity
- Collaboration
 - Email
 - Resource sharing

- Access to Experts outside college or locale

The above differences at the moment are not showing up in the research as making a significant difference between CBI and WBL, however the study by (Wisher and Olson 2003) on page 12 discusses that they expect to see significantly larger improvements in performance in WBL due to technology improvements over time.

2.9 Issues with eLearning

There are a number of challenges and issues related to eLearning that can cause a high dropout rate or a poor learning experience. As referred to in (Homitz and Berge 2008) these can be caused by:

- Instructor issues involving competences, feedback, and suitability for WBL
- Technical Difficulties
- Poor course design

(Robert 2005) reiterated this with findings that if subjects struggle with the technology and usability and feel isolated they are unlikely to complete a course or engage in a future eLearning opportunity.

The human element in eLearning should not be understated as we have seen in the improvement in performance in WBL courses that have an assigned web tutor. In addition if a web-based tutor is not available subjects may not find the course particularly useful. This was borne out in the “My Tennis World” study where a number of the subjects found the web based coach very useful in guiding them through the process and has also been borne out in qualitative feedback in a paper from (Cross 2004b). Having an assigned web-based tutor available reduces the chance of subject isolation if a subject is struggling with a concept and regular interaction with a web-based tutor can keep the subject focused and motivated. In the “My Tennis World” study the results show a significant positive improvement in performance. When the subjects were asked why they believed the improvement was so significant their qualitative results suggested that the process gave them focus and they could work on these focus areas with the coach on-line on a one-to-one basis and get immediate feedback to their questions. They also knew they were going to be assessed again so this was also a motivating factor in wanting to show an improvement in their score.

If the appropriate technology is not used or if the technology is unreliable in delivering a web-based course this again will result in the loss of subject confidence towards WBL.

The course design is key, as it is not enough just to upload the static course content into a web-based learning environment and give access to the subjects. A good WBL course design will incorporate tutor and student interactivity creating an online community and allow the uploading and sharing of subject generated content.

Another factor to be considered as a potential issue when designing a WBL course is the number of students interacting with it. From a technical perspective the platform must be robust and scalable. The proper number of designated web-based tutors should also be available. If these two considerations are

not met the subject experience will not be acceptable and the effectiveness benefits of WBL courses will not be realised. This effect was observed in a study by (Bennett 2002).

One downside in the use of subject generated content in the WBL world is that proper mediation of the eLearning environment needs to be undertaken by relevant qualified staff to ensure that any intellectual property issues and legal liability issues are managed. (Diaz 2011)

2.10 eLearning in Sport

As discussed in earlier sections, no prior art could be found in the area for the research question to determine the effectiveness of web-based learning in sport, however technology is in use in sports training and in this section we will look at that prior art and what it has to say.

Video analysis is in use for most sports now and in particular athletics, however no research has been done to determine its effectiveness. SiliconCoach Warp is one such WBL tool in use and it allows detailed analysis of video content (Wilson 2008). One area that is used in sport is the access to the “expert coach”. This is where a sporting organisation doesn’t have or can’t afford to have some particular expertise in the club or access to it in the locality and they can now access it in a structured way using the web (Rossett & Marino, 2005). Automatic tracking of athlete’s performance is also in use in such sports as Rugby and Badminton. In Badminton a WBL package called NI Vision is in use which, using fixed cameras, it can determine the pattern of play in a game.

There are some examples out there like the Hardiness Institute (www.hardinessinstitute.com) that have subjects take tests using the web and give feedback, however there is no community and no real interactivity and to get any real feedback and interactivity you must be in their local area. The lack of interactivity is the main area that seems to be missing from these web-based sports learning sites. There is a lot of generic content and some even have forums and blogs but there are no structured programmes or assigned coaches and regular planned interactions or engagements.

2.11 Current Examples

There are currently a number of web applications available in the marketplace that deliver some but not all of elements in this study's application. Some examples would be:

- Essential Tennis (Westermann 2012) – this site can be accessed at www.essentialtennis.com . This site provides access to stock video footage of different strokes. It is also possible to purchase packaged tennis development programs.
- Fuzzy Yellow Balls (Hamilton 2013) – this site can be accessed at www.fuzzyyellowballs.com . This site provides access to stock video footage of different strokes. It is also possible to purchase packaged tennis development programs.

There are a lot of other sites out there like these but none of them provide the ability to have your own information and storage area to upload and discuss content and none of them provide the Web 2.0 levels of interactivity and information sharing. They are traditional brochure type web sites.

2.12 ITF ITN Assessment

The ITF (International Tennis Federation), the governing body of world tennis, has an internationally recognised assessment method for determining the performance levels of players – the ITN (International Tennis Number) (ITF 2012). The ITF ITN assessment system is explained in detail at the following link <http://www.tennisplayandstay.com/media/131803/131803.pdf> (ITF 2012), but in summary it breaks the game of tennis into five quantifiable domains comprising of:

- Ground Stroke Depth
- Ground Stroke Accuracy
- Volley Depth
- Serving
- Mobility

The first four domains are stroke based assessments and are further sub divided into sub areas as Backhand, Forehand and the ability to consistently hit certain designated areas of the tennis court. The fifth domain is around tennis court mobility and athleticism and comprises a speed and dexterity assessment.

The scoring system is straightforward, fair and easy to understand for coach and player as shown in Figure 8 below.

International Tennis Number — On Court Assessment

Name: _____		Date of Birth: _____		Sex: M F	
Assessor: _____		Date: _____		Venue: _____	

GS Depth			Volley Depth			GS Accuracy			Serve		
Stroke	#	Score	Stroke	#	Score	Stroke	#	Score	Stroke	#	Score
Forehand	1		Forehand	1		Forehand DL	1		1st Box Wide	1	
Backhand	2		Backhand	2		Backhand DL	2		1st Box Wide	2	
Forehand	3		Forehand	3		Forehand DL	3		1st Box Wide	3	
Backhand	4		Backhand	4		Backhand DL	4		1st Box Middle	4	
Forehand	5		Forehand	5		Forehand DL	5		1st Box Middle	5	
Backhand	6		Backhand	6		Backhand DL	6		1st Box Middle	6	
Forehand	7		Forehand	7		Forehand CC	7		2nd Box Middle	7	
Backhand	8		Backhand	8		Backhand CC	8		2nd Box Middle	8	
Forehand	9		Sub Total			Forehand CC	9		2nd Box Middle	9	
Backhand	10		Consistency			Backhand CC	10		2nd Box Wide	10	
Sub Total			Volley Depth Total			Forehand CC	11		2nd Box Wide	11	
Consistency						Backhand CC	12		2nd Box Wide	12	
GS Depth Total						Sub Total			Sub Total		
						Consistency			Consistency		
						GS Accuracy Total			Serve Total		

Mobility Table		Time	Score																							
T	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
S	1	2	3	4	5	6	7	8	9	10	11	12	12	14	15	16	18	19	21	26	32	39	45	52	61	76
Score (F)	57-79	80-108	109-140	141-171	172-205	206-230	231-258	259-303	304-344	345-430																
Score (M)	75-104	105-139	140-175	176-209	210-244	245-268	269-293	294-337	338-362	363-430																
ITN	ITN 10	ITN 9	ITN 8	ITN 7	ITN 6	ITN 5	ITN 4	ITN 3	ITN 2	ITN 1																

Signed by/belief of the player:

Signed by the Assessor:

Strokes Total	Mobility Score	Total Score

Number of Assessments	New ITN Rating

what's your number?



International Tennis Number

This ITN Assessment was conducted in accordance with the guidelines set forth in the Official ITN Assessment Guide. I hereby agree to its authenticity.

Figure 8 - ITN Assessment Form

The ITN scale goes from 1 to 10

- ITN 1 - This player has had intensive training for national tournament competition at the junior and senior levels and has extensive professional tournament experience. Currently holds or is capable of holding an ATP / WTA ranking and their major source of income is through tournament prize money.
- ITN 2 - This player has power and / or consistency as a major weapon. Can vary strategies and styles of play in a competitive situation. The player is usually a nationally-ranked player.
- ITN 3 - This player has good shot anticipation and frequently has an outstanding shot or attribute around which a game may be structured. Can regularly hit winners and force errors off short balls. Can put away volleys and smashes and has a variety of serves to rely on.
- ITN 4 - This player can use power and spins and has begun to handle pace. Has sound footwork, can control depth of shots, and can vary game plan according to opponents. Can hit first serves with power and can utilise spin on second serves.
- ITN 5 - This player has dependable strokes, including directional control and depth on both groundstrokes and on moderate shots. The player has the ability to use lobs, overheads, approach shots and volleys with some success.

- ITN 6 - This player exhibits more aggressive net play, has improved court coverage, improved shot control and is developing teamwork in doubles.
- ITN 7 - This player is fairly consistent when hitting medium paced shots, but is not yet comfortable with all strokes. The player lacks control over depth, direction and power.
- ITN 8 - This player is able to judge / control where the ball is going and can sustain a short rally.
- ITN 9 - This player needs on court experience, while strokes can be completed with some success.
- ITN 10 - This player is starting to play competitively (can serve rally and score) on a full court using a regular ITF approved Yellow ball.

(ITF 2012)

2.13 Area of contribution

The area of contribution for this study is to provide the first research in determining the effectiveness of Web-based learning in Sport. As discussed earlier in this paper WBL tools are in use in sport but in an ad-hoc way and no proper academic analysis has been done to measure the effectiveness of the use of these tools. This is the starting point for a whole new area of WBL research. More detailed and extensive research with bigger sample sizes, longer periods and with different sports could be carried out in the future.

Two tennis organisations have indicated an interest in publishing the approved findings of this study. The ITF Magazine and PTR (Professional Tennis Registry) (PTR 2013) are targeted for publication of an abstract of the findings of the study and depending on the abstract, conference opportunities could arise.

2.14 Key factors in the success of WBL

There are a number of key factors outside of the course design and quality of the software development of web applications mentioned earlier that are key to the success of WBL. In this section we briefly highlight these factors. All the statistics mentioned in this section are taken from the ITU (International Telecommunication Union), a United Nations agency which is responsible for information and communication technologies, data released in June 2012 (ITU 2012).

2.14.1 Access to the Web

Access to the web is growing significantly year on year:

- By the end of 2011 2.3 billion people were using the web
- In the last four years the number of people using the web in developing countries has doubled
- 25% of the population of the developing world have access to the web.
- In the developed world 70% of all individuals have access to the internet and in certain countries that is as high as 90%

As you can see from the statistics above, (ITU 2012), access to the web is now pervasive in developed countries and is growing at a rapid rate in developing countries.

2.14.2 Connectivity both fixed and wireless

Fixed broadband technology has enabled adequate broadband to be available to most areas of the developed world and is still growing at a rate of 5% per year. The real growth in connectivity is in the wireless domain in the developing countries. There are now 6 billion mobile subscriptions accounting for 86% global penetration. 80% of the growth in 2011 was in developing countries. Mobile broadband is growing by 40% per year (ITU 2012).

The average worldwide connectivity speed is now 3Mbps on the downstream and growing by 15% year on year (Belson 2012). In the developed world average broadband connectivity speeds are higher with some examples being the UK at 5.7Mbps, Ireland at 6.2Mbps, Germany 5.8Mbps, South Korea 14.2Mbps and the USA at 6.6Mbps (Belson 2012). However these Figures are rising fast with many countries having access to 100Mbps or more. Also with the introduction of 4G Mobile networks, mobile broadband speeds of up 100Mbps are possible (Martin 2012).

2.14.3 Devices

WBL on the move will be a growing trend over the next few years and will be especially beneficial in the sports learning domain as it will enable subjects to generate, upload, download, share and interact with content and other users whilst actually participating in a sporting event. The two main devices that will be used in this domain are the Smart phone and Tablet.

Smart phones now account for 38.4% of all handsets shipped (686 million), with android being the dominant operating system now – see Table 2 below (mobiThinking 2012).

Table 2 - Worldwide Smartphone Operating System 2012 and 2016 Market Share and 2012-2016 Compound Annual Growth Rate

Smartphone OS	2012 Market Share	2016 Market Share	2012 - 2016 CAGR
Android	61.0%	52.9%	9.5%
Windows Phone 7/Windows Mobile	5.2%	19.2%	46.2%
iOS	20.5%	19.0%	10.9%
BlackBerry OS	6.0%	5.9%	12.1%
Others	7.2%	3.0%	-5.4%
Total	100.0%	100.0%	12.7%

Tablets are now growing in penetration with 122 million of them sold last year with this rising to 172 million in 2013. The operating system battle here is closer here with Apple having 54% and Android 43% (mobiThinking 2012).

These smart mobile devices which are growing in penetration year on year in conjunction with the growing availability of wireless broadband will enable WBL to move into the sports domain with the possibilities of real-time interactive information and feedback exchanges between players and coaches whilst participating in training or competition. This has the potential to significantly increase the effectiveness of web-based learning in sport.

3 Technical Overview

To conduct my research an application was created to enable Web-Based Tennis Instruction. In this section the scope of works and requirements will be explained, the methodology used to develop the application will be described, and the tools and frameworks used will be identified. Some examples are given from similar sites, the motivation and key aims are explained and a look is taken at the main areas of the final application.

3.1 Scope and Requirements

A website was required to allow the subjects and coaches to:

- Both:
 - Have a password protected personal account
 - Hold their relevant personal details
 - Upload, view and share content
 - Hold scheduled, interactive and recorded chats
- Subjects:
 - See their assessments, videos and programs on one page
 - Pick their own coach
- Coaches:
 - Assign programs and give assessment results to subjects
 - See all the subjects attached to them
 - View all the assessment, program and video information for their subjects

All this is delivered using good usability practices and ensuring the learning process is an intuitive, easy and enjoyable experience.

A more detailed explanation of the main areas is given in the subsequent sections.

3.1.1 My Details Area

Users should be able to create an account and log in to access their personalised information. The information they can give is as follows:

Table 3 - My Details Fields

My Details Fields		
Forename	Surname	Date of Birth
Sex	Email address	Address
Availability to be coached	Skill Level	Mobile No.
Coach(s)	Club(s)	Picture

This is a subscription site so it needs to allow users to:

- Create an account
- Update the account
- Sign into the site
- Logout of the site
- Not let the same email address be added twice
- Allow for password changes

3.1.2 My Profile Area

Should enable subjects to:

- View their ITF ITN Assessment scores given to them by their coach
- View all their own and shared videos
- Upload, edit, delete and share video content
- View assigned programs from coach

3.1.2.1 Coaching assessment scores

Table 4 - ITF ITN Assessment Scores Fields

ITF ITN	Assessment	Fields		
ITN	Overall ITN	No. of Assessments	GS Depth F1	GS Depth B2
GS Depth F3	GS Depth B4	GS Depth F5	GS Depth B6	GS Depth F7
GS Depth B8	GS Depth F9	GS Depth B10	GS Depth Sub Tot	Consistency
GS Depth Tot	V Depth F1	V Depth B2	V Depth F3	V Depth B4
V Depth F5	V Depth B6	V Depth F7	V Depth B8	V Depth Sub Tot
Consistency	V Depth Tot	GS A FDL1	GS A BDL2	GS A FDL3
GS A BDL4	GS A FDL5	GS A BDL6	GS A FCC7	GS A BCC8
GS A FCC9	GS A BCC10	GS A FCC11	GS A BCC12	GS A Sub Tot
Consistency	GS A Tot	S 1 W 1	S 1 W 2	S 1 W 3
S 1 M 4	S 1 M 5	S 1 M 6	S 2 M 7	S 2 M 8
S 2 M 9	S 2 W 10	S 2 W 11	S 2 W 12	S Sub Tot
Consistency	S Total	Stokes Total	Mobility Score	Total Score
Date of Ass	Coach	Venue		

Each of the assessments are indexed by date and cannot be edited – given by the coach

3.1.2.2 Other My Profile Data

Videos – Date, time, coach, detail, YouTube url – should be able to add, delete, share on each one and have a list

Click on URL: and watch a video in the window

Program – text – given to them by coach, date, time, coach – sent to them by coach

Coach screens are very similar – My Details screen would be identical but the My Coaching screen would be different. The My Profile tab for a coach would have Programs, Assessments, Videos, Players, driven by the player so they select a player and all their latest programs, assessments, videos, chats appear - they will also have a list of all linked and shared videos.

3.1.3 Chat Area

Subjects can schedule chats with coach

Coach can accept or reject chats

Subject and coach can attend live web chat sessions

Chat sessions stored – date, time, coach, topic, detail (i.e. all the chat information from both sides)

3.1.4 Logging

System should keep a log of all user activity whilst the user is logged into the site:

- Every Login with time and date
- Every page they visit

This log should be available to the administrator

3.1.5 Messaging

Enable the ability to send a message with text and video attachment to another user.

Ability to schedule, accept, reject and attend chats.

3.1.6 Use Cases

3.1.6.1 ITF Score Update

- Coach logs in
- Coach can bring up a user by name and enter scores from ITF evaluation
- Scores then appear on users account with a time, date, and coach id stamp
- User gets notification
- Coach ITN Score Screen should look like figure 9:

International Tennis Number — On Court Assessment

Name: _____		Date of Birth: _____		Sex: M F	
Assessor: _____		Date: _____		Venue: _____	

what's your number?



International Tennis Number

GS Depth			Volley Depth			GS Accuracy			Serve		
Stroke	#	Score	Stroke	#	Score	Stroke	#	Score	Stroke	#	Score
Forehand	1		Forehand	1		Forehand DL	1		1st Box Wide	1	
Backhand	2		Backhand	2		Backhand DL	2		1st Box Wide	2	
Forehand	3		Forehand	3		Forehand DL	3		1st Box Middle	3	
Backhand	4		Backhand	4		Backhand DL	4		1st Box Middle	4	
Forehand	5		Forehand	5		Forehand DL	5		1st Box Middle	5	
Backhand	6		Backhand	6		Backhand DL	6		2nd Box Middle	7	
Forehand	7		Forehand	7		Forehand CC	7		2nd Box Middle	8	
Backhand	8		Backhand	8		Backhand CC	8		2nd Box Middle	9	
Forehand	9		Sub Total			Forehand CC	9		2nd Box Wide	10	
Backhand	10		Consistency			Backhand CC	10		2nd Box Wide	11	
Sub Total			Volley Depth Total			Forehand CC	11		2nd Box Wide	12	
Consistency						Backhand CC	12		Sub Total		
GS Depth Total						Sub Total			Consistency		
						GS Accuracy Total			Serve Total		

This ITN Assessment was conducted in accordance with the guidelines set forth in the Official ITN Assessment Guide. I hereby agree to it's authenticity.

Signed by/belief of the player: _____

Signed by the Assessor: _____

Strokes Total	Mobility Score	Total Score

Mobility Table	Time	Score
T 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15		
S 1 2 3 4 5 6 7 8 9 10 11 12 12 14 15 16 18 19 21 26 32 39 45 52 61 76		
Score (F)	57-79	80-108
Score (M)	75-104	105-139
ITN	ITN 10	ITN 9

Number of Assessments	New ITN Rating

Circle players ITN level after completing the Assessment.

Figure 9 - ITF ITN Assessment Screen Results

3.1.6.2 Program Update

- Coach logs in
- Coach can create a new program (text) for a subject and send it to them
- Updated program appears on users account with a time, date and coach id
- Subject gets and email alert advising them of an updated Program

3.1.6.3 Coaches My Profile

- List of all current subjects
- Can click on them and bring up their details (except password change)
- Programs set for them
- ITN scores
- List of all ITN scores and Programs
- Can click and bring it up
- Can see list of scheduled chats and can click to see who and any content attached

3.1.6.4 Schedule Coaching Session

- User logs in
- Looks to find a coaching slot in calendar
- Clicks on coaching slot and can enter text and attach video clip (if they have one)
- Calendar is updated

3.1.6.5 Attend a Coaching Chat Session

- User and Coach get email / text telling them that their coaching session is to begin in 15 mins
- User and Coach log into site
- At appropriate time private chat session is started between user and coach
- Chat until session ends
- Chat is recorded

3.1.6.6 Email Feedback

- User logs in
- Creates email with query and video if necessary and sends to coach
- Coach sends email back with feedback

3.1.6.7 Alerts

- Email / text alerts for coaching sessions to both player and coach
- Email / text alerts when new content is posted to the users / coaches account

3.1.7 User Account Administration

- 3 levels of user
 - Administrator
 - Coach
 - Player

3.2 Technical Configuration

The application was developed using Ruby (v1.9.3) on Rails (3.0.10), HTML5, JavaScript, jQuery, AJAX, SQLite 3 and CSS3. The OS used was Windows. Github was used as code repository and also to deploy to the Heroku platform where the application can be accessed at blooming-lake-8379.herokuapp.com. The Ruby on Rails MVC (Model View Controller) Architecture was used. The Web Application was designed to work on, and was tested on, the following browsers:

- Google Chrome v23.0.1271.97
- IE v9.0.8112.16421
- Firefox
- Android Ice Cream Sandwich

3.2.1 Ruby

Ruby is an Object Oriented programming language. Everything in Ruby is an Object. It is an interpreted, dynamic language. Ruby works on most operating systems. It was used on this project because it allowed the quick creation and organisation of the views that were needed and in conjunction with Rails provided the ideal platform for Agile and iterative development as it easily allows the testing of changes / additions made to the application. (MembersoftheRubyCommunity 2013)

3.2.1.1 Devise

Devise is a comprehensive and easy to use authentication framework for Ruby on Rails applications. It is fully customizable and provided all the user management functionality required for this WBL tool. (rubygems.org 2013a)

3.2.1.2 Oauth2

The Oauth2 gem is a Ruby wrapper for the OAuth 2.0 protocol. (Rubygems.org 2013b)

3.2.1.3 Paperclip 3

Paperclip 3 enables the use of attachments and uploads in a Ruby on Rails application. (github 2013b)

3.2.1.4 Aws-sdk

Aws-sdk provides Ruby classes for many AWS services including Amazon S3, Amazon EC2, DynamoDB, and more. (Amazon 2013). This was used to save images on the Heroku platform. (Amazon 2013)

3.2.2 Rails

Rails is a web application development framework written in the Ruby language.

There are three main characteristics of Rails:

- DRY – “Don’t Repeat Yourself” – suggests that writing the same code over and over again is a bad thing.
- Convention Over Configuration – means that Rails makes assumptions about what you want to do and how you’re going to do it, rather than requiring you to specify every little thing through endless configuration files.
- REST is the best pattern for web applications – organizing your application around resources and standard HTTP verbs is the fastest way to go.

(Dev, Noria et al. 2013)

3.2.3 MVC

At the core of Rails is the Model, View, Controller architecture, usually just called MVC. MVC benefits include:

- Isolation of business logic from the user interface
- Ease of keeping code DRY
- Making it clear where different types of code belong for easier maintenance

A Model represents the information (data) of the application and the rules to manipulate that data. In the case of Rails, models are primarily used for managing the rules of interaction with a corresponding database Table. In most cases, one Table in your database will correspond to one model in your application. The bulk of an application’s business logic will be concentrated in the models.

Views represent the user interface of your application. In Rails, views are often HTML files with embedded Ruby code that perform tasks related solely to the presentation of the data. Views handle the job of providing data to the web browser or other tool that is used to make requests from your application.

Controllers provide the “glue” between models and views. In Rails, controllers are responsible for processing the incoming requests from the web browser, interrogating the models for data, and passing that data on to the views for presentation.

(Dev, Noria et al. 2013)

3.2.4 HTML5

HTML or HyperText Markup Language is a way of denoting how a browser should render text & media, via metadata surrounding the content. HTML provides content structure & presentation details.

HTML5 is currently under development as the next major revision of the HTML standard. HTML5 adds new syntactical features like <video>, <audio>, and <canvas> elements. HTML5 extends and improves the markup available for documents (article, nav, header & section tags, for example) and introduces markup for application programming interfaces (APIs) for complex web apps.

HTML5 is suitable for cross-platform mobile applications, as many of its features have been built considering the ability to run on low-powered devices like smartphones & Tablets (Wikipedia 2013a).

3.2.5 CSS3

CSS is a web-based markup language used to describe the look and formatting of a website to the browser. CSS allows developers to build content-rich web pages with relatively lightweight code requirements. This means: fancier visual effects, better user interfaces, and more importantly, cleaner pages that load faster.

New features of CSS3 include the following and more:

- Border: border-colour/border-image/border-radius/box-shadow
- Backgrounds: background-origin/background-size/multiple backgrounds
- Text effect: text-shadow/text-overflow/word-wrap
- Media Queries
- Multi-column layout
- Web fonts

(CSS3.COM 2013)

3.2.6 JavaScript

JavaScript® (often shortened to JS) is a lightweight, interpreted, object-oriented language with first-class functions, most known as the scripting language for Web pages, but used in many non-browser environments as well such as node.js or Apache CouchDB. (MDN 2013)

The JavaScript standard is ECMAScript. As of 2012, all modern browsers fully support ECMAScript 5.1. Older browsers support at least ECMAScript 3. (MDN 2013)

3.2.6.1 jQuery

jQuery is a fast and concise JavaScript Library that simplifies HTML document traversing, event handling, animating, and Ajax interactions for rapid web development. (ThejQueryFoundation 2013a)

3.2.6.1.1 *DatePicker*

The datepicker is tied to a standard form input field. Focus on the input (click, or use the tab key) to open an interactive calendar in a small overlay. Choose a date, click elsewhere on the page (blur the input), or hit the Esc key to close. If a date is chosen, feedback is shown as the input's value. (ThejQueryFoundation 2013b)

3.2.6.1.2 *Fancybox*

Fancybox is a tool for displaying images, html content and multi-media in a Mac-style "lightbox" that floats overtop of web page.

It was built using the jQuery library. Licensed under both MIT and GPL licenses.

- Can display images, HTML elements, SWF movies, iframes and also Ajax requests
- Customizable through settings and CSS
- Groups related items and adds navigation.
- If the mouse wheel plugin is included in the page then Fancybox will respond to mouse wheel events as well
- Support fancy transitions by using easing plugin
- Adds a nice drop shadow under the zoomed item

(fancybox.net 2013)

3.2.6.1.3 *History.js*

History.js gracefully supports the HTML5 History/State APIs (pushState, replaceState, onPopState) in all browsers. Including continued support for data, titles, replaceState.

Supports jQuery, MooTools and Prototype. For HTML5 browsers this means that you can modify the URL directly, without needing to use hashes anymore. For HTML4 browsers it will revert back to using the old onhashchange functionality. (Lupton 2013)

3.2.6.2 AJAX

Ajax an acronym for Asynchronous JavaScript and XML is a group of interrelated web development techniques used on the client-side to create asynchronous web applications. With Ajax, web applications can send data to, and retrieve data from, a server asynchronously (in the background) without

interfering with the display and behaviour of the existing page. Data can be retrieved using the XMLHttpRequest object. Despite the name, the use of XML is not required (JSON is often used instead), and the requests do not need to be asynchronous (Wikipedia 2013b).

3.2.7 SQLite

SQLite is a software library that implements a self-contained, serverless, zero configuration, transactional SQL database engine. SQLite is the most widely deployed SQL database engine in the world. The source code for SQLite is in the public domain (SQLiteConsortium 2013).

3.2.8 github

GitHub is the best place to share code with friends, co-workers, classmates, and complete strangers. Over two million people use GitHub to build amazing things together.

With the collaborative features of GitHub.com, our desktop and mobile apps, and GitHub Enterprise, it has never been easier for individuals and teams to write better code, faster.

GitHub has grown into the largest code host in the world. (github 2013a)

3.2.9 Heroku

Heroku is a cloud application platform – a new way of building and deploying web apps. It works really well with Ruby on Rails and it was ideal for this project as it was an easy way to deploy this application for use amongst a diverse user population.

(Heroku 2013)

3.2.10 Development Discussion

The characteristics of this study meant that there was only a limited window of time to develop a useful WBL tool (4 weeks). The Ruby on Rails environment was ideal as it enabled RAD (Rapid Application Development) using an Agile and iterative development methodology.

All my previous development experience with Ruby on Rails had been using the college virtual box. However as this was an application I intend to develop further outside of this process when the course ends I used the Windows 7 platform to develop on, which caused a few issues. I also wanted to use MySQL.

The main issues I encountered in the development of this web application were:

- Had to adjust to working in a Windows 7 environment from Ubuntu in a Virtual Box.
- Had to move from MySQL to SQLite to enable deployment as I had major issues working with MySQL and in the end opted for SQLite which was much more straightforward.
- Issues with Heroku db:pull and db:push
 - o There was an issue with the role not always being populated when a subject signed up, fixed it, and then tried to push the “fixed” database by doing a Heroku db:pull and db:push and changing it locally – caused a 3 day outage at the beginning of the process

Stack Overflow was used extensively to help in resolving development issues (stackoverflow 2013).

3.2.11 My Tennis World

3.2.11.1 Controllers

Table 5 - Ruby Controllers

<i>Controllers</i>		
Coachingscontroller	Applicationcontroller	Assesmentscontroller
ChatSchedulesController	MessagesController	ProgramsController
SessionsController	UsersController	VideosController

3.2.11.2 Helpers

The only Ruby helper that was used was ApplicationHelper.

3.2.11.3 Mailer

UserMailer looks after all the email functionality of the application.

3.2.11.4 Models

The following Models were used in this application:

- Assessment
- Message
- Program
- User
- UserConnection
- Video

3.2.11.5 Views

- Admin
 - o Edit
- Index
 - o View_page_count
- Assessments
 - o Show
 - o User_assessments
- Chat_schedules
 - o Chat_history_with_user
 - o Index
 - o Show
 - o View_history
- Coachings
 - o _backhand
 - o _equipment
 - o _get_all_coaches
 - o _improvemyshots
 - o _index
 - o _list
 - o _tactics
 - o All_users
 - o Assess_user
 - o Coaching
 - o Get_coaches

- Devise
 - Confirmations
 - New
 - Mailer
 - Confirmation_instructions
 - Reset_passwords_instructions
 - Unlock_instructions
 - Passwords
 - Edit
 - New
 - Registrations
 - Edit
 - New
 - Sessions
 - New
 - Shared
 - _links
 - Unlocks
 - New
 - Layouts
 - Admin
 - Application
 - Messages
 - _chat_history_show
 - Programs
 - All_programs
 - Assign_program

- Show
- Sessions
 - New
- User_mailer
 - Chat_schedule_request
 - Send_schedule_status
 - Send_video_link
- Users
 - _chat_history
 - _chat_window
 - _get_latest_video
 - Get_role
 - My_Profile
 - My_Profile_back
- Videos
 - _add_video
 - _edit_video
 - _form
 - Add_video
 - Add_video.js
 - All_videos
 - Edit
 - Edit_video.js
 - Share_video.js
 - Show

3.2.11.6 Config

- Environments
 - Development
 - Production
- Initializers
 - Devise
 - Secret_token
 - Session_store
- Routes
- Db
 - Migrate
- CSS
 - Base
 - Layout

3.3 Methodology

This web application was developed with an Agile, Iterative and Lean approach leading to the creation of an MVP (Minimum Viable Product) in the shortest period of time possible. This approach meant that each piece of code that was written was tested immediately and every day all the use cases were gone through to ensure they were all still working and that any of the developments done during the day have not had any knock on effects to other areas. Ruby on Rails was an ideal platform to enable this mode of working.

3.4 Motivation

While CBI and WBL have been proven to work in an academic setting no such evidence could be found in the sports learning domain. The purpose of this study was to ascertain whether the findings in the academic world could be replicated in the sports domain and to measure these effects. There is also a problem for the coaches as they embrace Web 2.0 functionality such as video analysis, interactive chat etc... They have no structured way of managing and sharing their interactions with their clients i.e. the Players. This site will also aid them as they will have the ability to arrange and monitor their clients programs, chats, share video analysis content and other material in a structured interactive manner.

3.5 Key Aim

The key aim of this site was to provide an effective tool capable of determining the effectiveness of web-based learning in sport.

3.6 Application

This section illustrates how the site looks and performs some of the main use cases employing screen shots from the actual application. The home page can be seen in the Figure 10 below. It allows users who are not logged in to access generic video and text content around the various tennis shots and information on equipment and tactics. If users want to use the site as an information repository to upload content and interact with coaches they have to create an account and log in. Coaches can also use the site to create an account and use it to manage their students coaching needs.



Figure 10 - Home Page

Coach registers via the web shown below in Figure 11:



Figure 11 - Coach Registration

Once the Coach has registered and logged in. They come to the home screen and can click on the “My Details” page to personalise their account (see Figure 12).

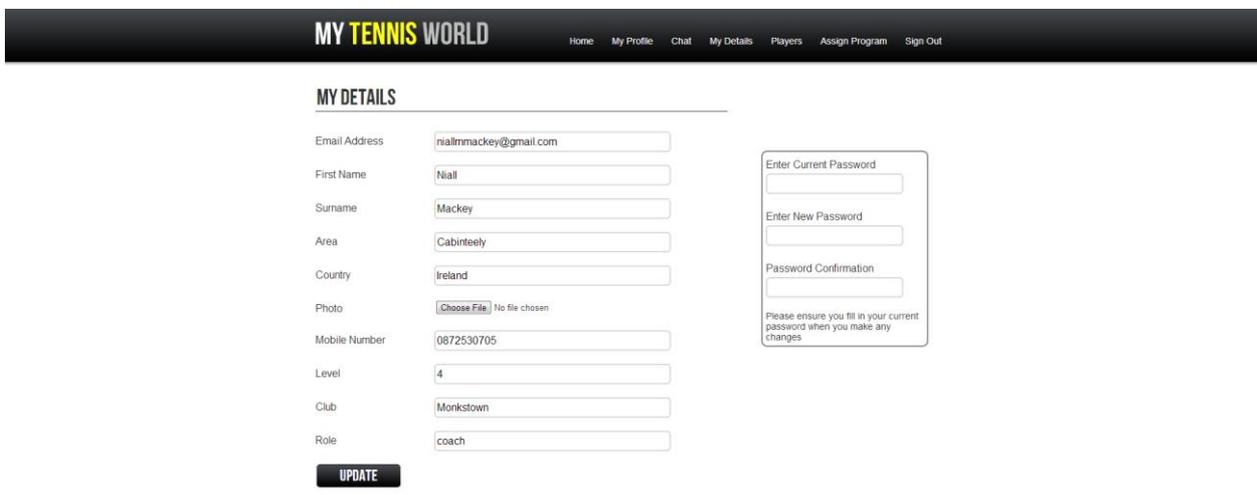


Figure 12 - My Details Page

The coach can then update their “My Profile” page and see any assessments they have given, programs assigned and videos uploaded and shared with subjects (see Figure 13).

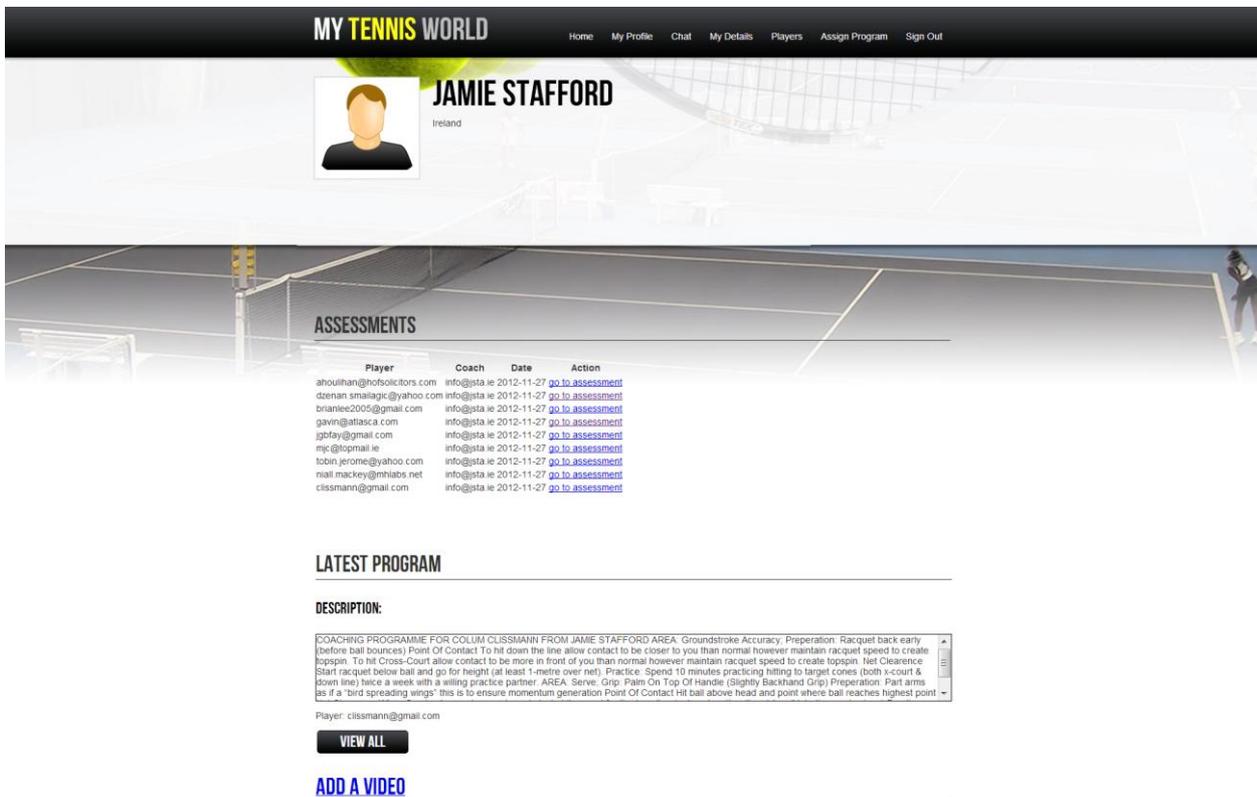


Figure 13 - My Profile Page (Coach)

The coach can then click on the “Players” page where they will see all the players they are coaching (see Figure 14).

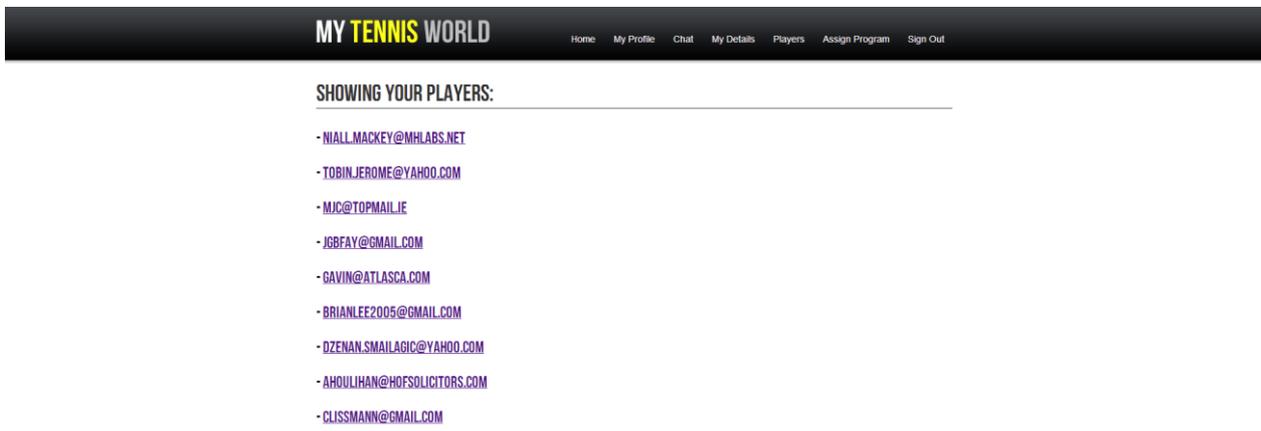


Figure 14 - Coaches Player listing page

The coach can then click on one of the subjects and assign a program for them to focus on (see Figure 15).

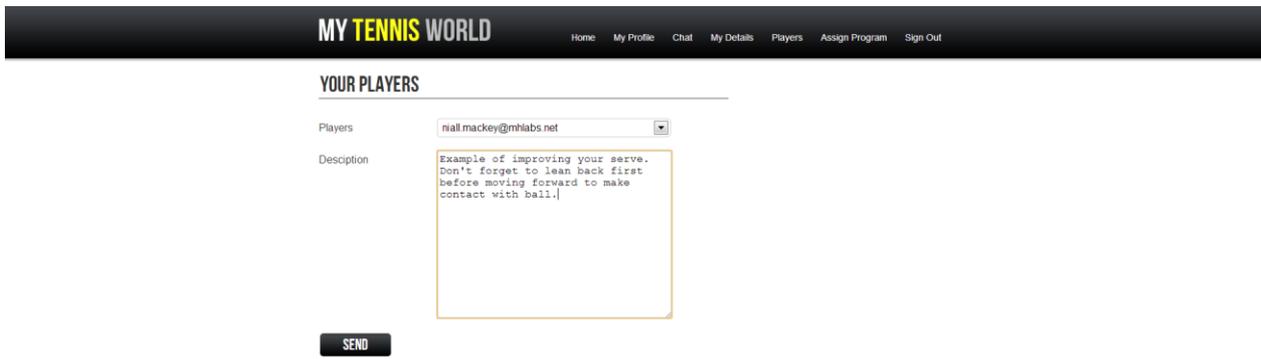


Figure 15 - Coach Assign Program

The coach can then click on the “Chat” page and see the list of chats they have accepted or rejected (see Figure 16).

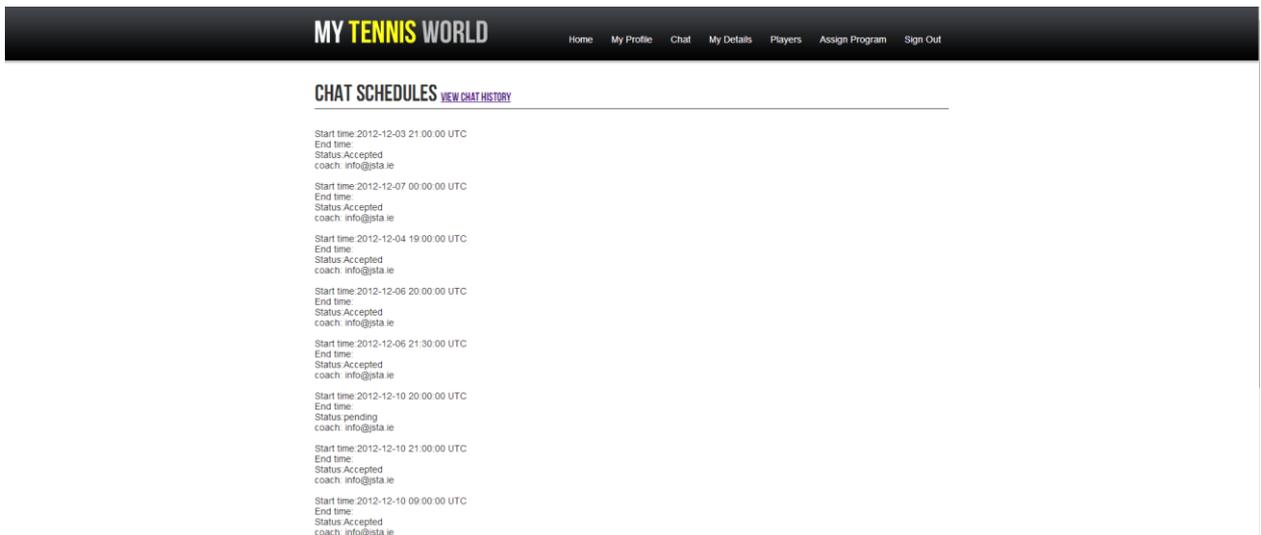


Figure 16 - Coach Chat History

The players see the same home page as the coach but see a different “My Profile” page (see Figure 20).

MY TENNIS WORLD
Home My Profile Chat My Details Coaches Sign Out


DZENAN SMAILAG

ASSESSMENTS

GS DEPTH		
STROKE	#	SCORE
forehand	1	0
forehand	3	6
forehand	5	8
forehand	7	6
forehand	9	2
backhand	2	8
backhand	4	0
backhand	6	1
backhand	8	2
backhand	10	4
SUB-TOTAL	37	
Consistency		
TOTAL	37	

[VIEW ALL](#)

VOLLEY DEPTH		
STROKE	#	SCORE
forehand	1	8
forehand	3	8
forehand	5	6
forehand	7	2
backhand	2	6
backhand	4	0
backhand	6	0
backhand	8	0
SUB-TOTAL	30	
Consistency		
TOTAL	30	

[VIEW ALL](#)

GS ACCURACY		
STROKE	#	SCORE
forehand DL	1	8
forehand	3	3
forehand DL	5	1
forehand DL	7	8
forehand DL	9	1
forehand DL	11	8
Backhand DL	2	8
Backhand DL	4	0
Backhand DL	6	1
Backhand DL	8	5
Backhand DL	10	8
Backhand DL	12	3
SUB-TOTAL	64	
Consistency		
TOTAL	64	

[VIEW ALL](#)

SERVE		
STROKE	#	SCORE
1st Box Wide	1	0
1st Box Wide	2	0
1st Box Wide	3	8
1st Box Middle	4	8
1st Box Middle	5	8
1st Box Middle	6	0
2nd Box Middle	7	0
2nd Box Middle	8	0
2nd Box Middle	9	0
2nd Box Wide	10	0
2nd Box Wide	11	0
2nd Box Wide	12	0
SUB-TOTAL	24	
Consistency		
TOTAL	24	

[VIEW ALL](#)

OTHERS		
STROKE	#	SCORE
Overall ITN Number		7.0
Strokes Total		145
Mobility Scores		39
total score		194

LATEST PROGRAM

DESCRIPTION:

COACHING PROGRAMME FOR DZENAN FROM JAMIE STAFFORD AREA BACKHAND: Grip: Palm on to of handle (eastern backhand grip) Preparation: Racquet back early (before ball bounces) Point Of Contact Ensure contact is in front of body Net Clearance Start racquet below ball and go for height (at least 1-metre over net). Practice: Spend 10 minutes practicing backhands twice a week off a wall or with a willing practice partner. AREA Volley: Grip: Chopper Grip (continental grip) Preparation: Turn body early (before ball bounces) Point Of Contact Ensure contact is in front of body Net Clearance When Volleying have a firm grip and aim to hit the baseline (outwards rather than "down" into the court). Practice: Spend 10 minutes practicing volleys twice a week off a wall or with a willing practice partner. AREA: Serve: Grip: Palm On Top Of Handle (slightly Backhand

Player: dzenan.smialag@yahoo.com

[VIEW ALL](#)

LATEST VIDEO



Forehands
Examples of forehands for review

Url: <http://www.youtube.com/embed/tpc9C6Z6/E>

[VIEW ALL](#)

[ADD A VIDEO](#)

Figure 20 - Players My Profile Page

The subject can then select a coach to engage with by clicking on the “Coaches” page (see Figure 21)

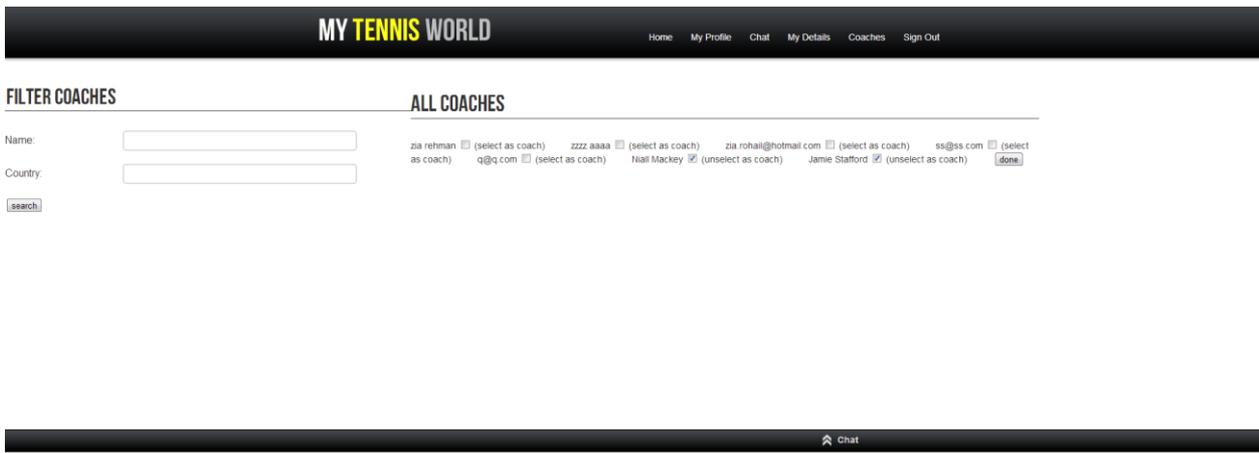


Figure 21 - Select Coach

To go to the Chat section click on the “Chat” page and you will see the scheduled chats (see Figure 22)

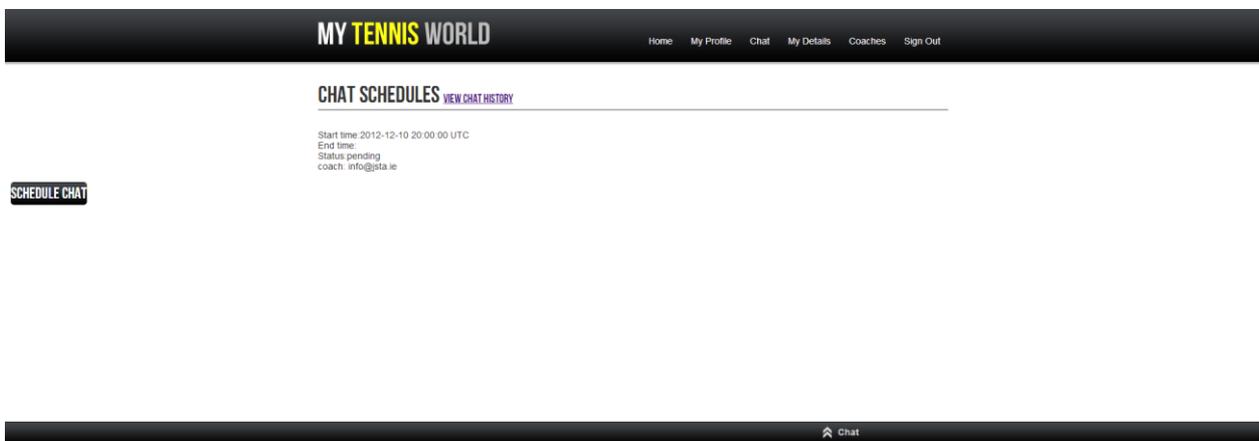


Figure 22 - Player Chat

The subject can click on the “Schedule Chat” button to schedule a chat with a coach (see Figure 23).

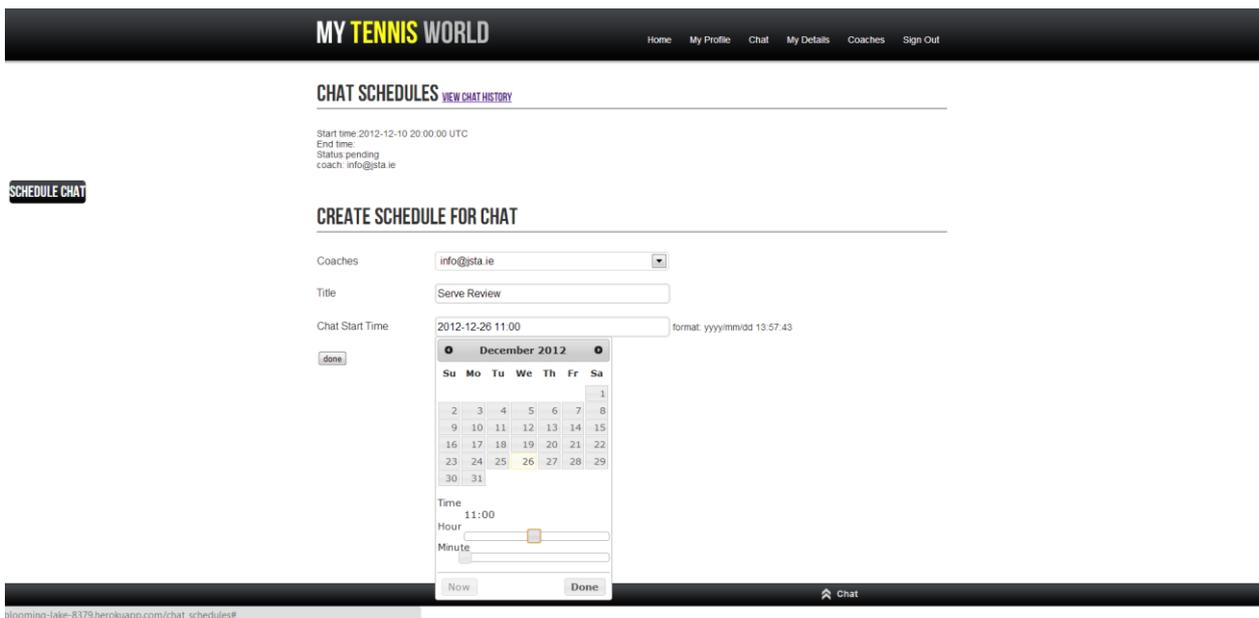


Figure 23 - Schedule Chat

The subjects can use the “How can we help?” section to look at generic content on how to improve their strokes, tactics and knowledge of tennis equipment (see Figure 24).

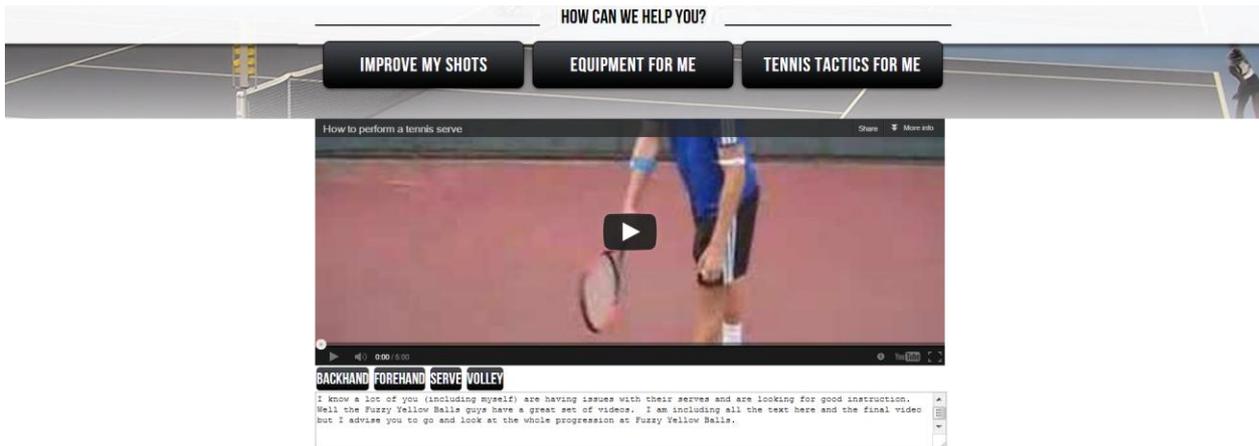


Figure 24 - How Can We Help You?

The third type of user in this system is the Administrator. The Administrator can change the content appearing in the “How Can We Help You?” section. You can see the Admin console below (see Figure 25).

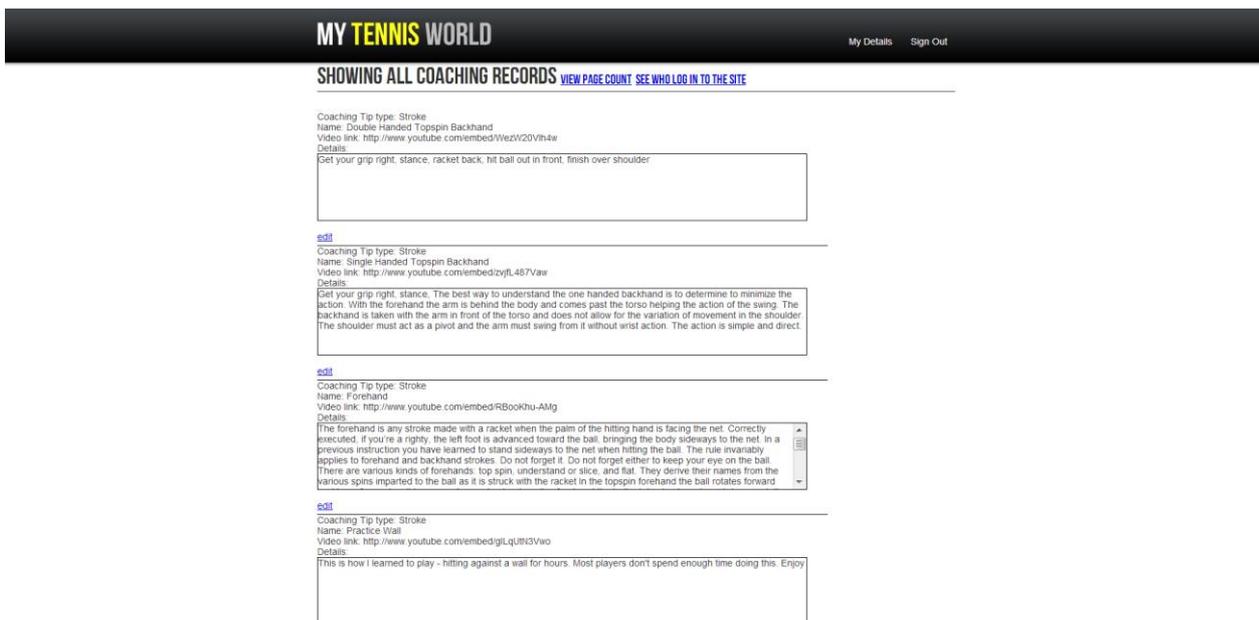


Figure 25 - Admin Console

If the admin clicks on the “View Page Content” they see the number of clicks on all the main pages (see Figure 26).

SHOWING ALL PAGES VIEW COUNT

%> Profile Page: 188
Chat Schedule Page: 210
My details Page: 66
Players Page for coaches: 55
Coaches Page for players: 24
Assign Program Page: 16
Assessment Show Page: 18
All Assessments Page: 6
Show Program Page: 6
All programs page: 12
Show Video Page: 29
All Videos Page: 21

Figure 26 - View Page Content

The admin can also view the Access Log by clicking on the “See who logged into the site” (see Figure 27).

SHOWING USERS

user: a@a.com
when: 2012-11-23 15:21:26 UTC
user: admin@admin.com
when: 2012-11-23 15:42:45 UTC
user: s@s.com
when: 2012-11-27 12:43:04 UTC
user: z@z.com
when: 2012-11-27 12:44:37 UTC
user: o@o.com
when: 2012-11-27 12:47:11 UTC
user: s@s.com
when: 2012-11-27 12:52:34 UTC
user: o@o.com
when: 2012-11-27 12:53:15 UTC
user: l@l.com
when: 2012-11-27 13:08:13 UTC
user: n@n.com
when: 2012-11-27 13:12:20 UTC
user: p@p.com
when: 2012-11-27 13:41:05 UTC
user: info@sta.ie
when: 2012-11-27 19:26:47 UTC
user: info@sta.ie
when: 2012-11-27 19:28:15 UTC
user: niallmackey@gmail.com
when: 2012-11-27 19:30:06 UTC
user: niallmackey@gmail.com
when: 2012-11-27 19:32:39 UTC
user: niall.mackey@mhiabs.net
when: 2012-11-27 19:33:41 UTC
user: niall.mackey@mhiabs.net
when: 2012-11-27 19:34:41 UTC

Figure 27 - View Page Content

4 Evaluation (Research Methodology)

In this study both quantitative and qualitative evaluation methods were used to test the research question “Determining the Effectiveness of Web Based Learning in Sport”.

4.1 Project Plan

As there were a number of discrete elements to this study a project plan and timeline was required to ensure a timely and focussed approach to this study as you can see in Figure 28 below.

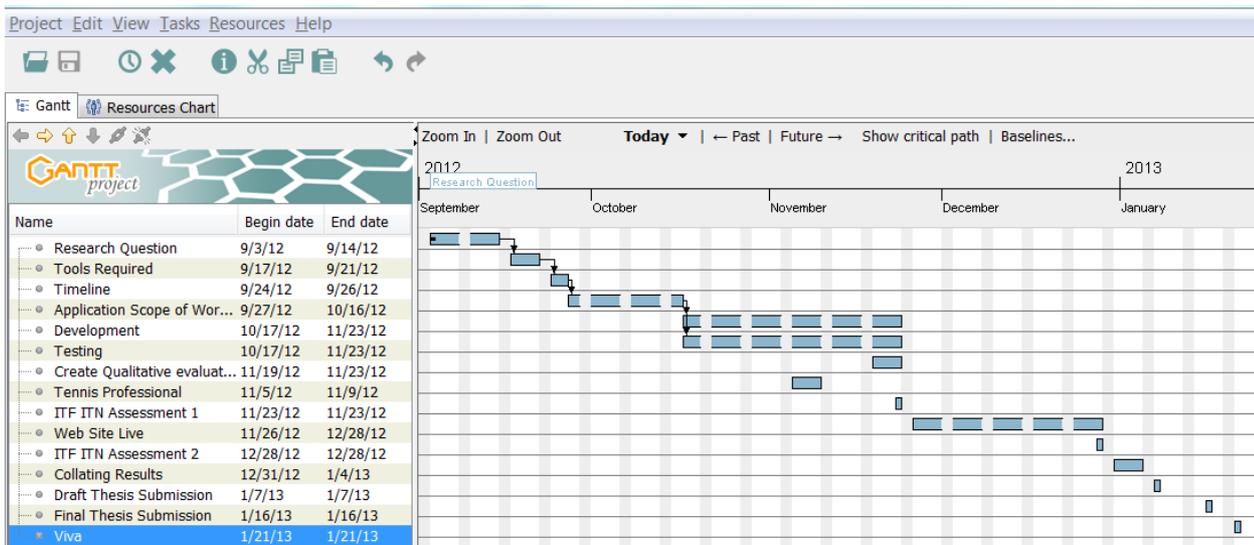


Figure 28 - Project Plan

4.2 Study Tennis Professional



The first step in the evaluation process especially in relation to the quantifiable elements of the study such as the ITF ITN Assessments was to find an independent fully qualified coach who was qualified to do the ITF ITN Assessments and would give the study credibility.

The coach recruited for this was Jamie Stafford. Jamie Stafford runs the JSTA (Jamie Stafford Tennis Academy) (Stafford 2012). They are a leading provider of tennis coaching to all standards and ages, run tennis camps, school programmes, club management and tournaments. (Stafford 2012)

Jamie started up JSTA in 2010 and since then the organisation has gone from strength to strength. Jamie has over 25 years' experience as a tennis coach and was a professional player prior to becoming a coach. Jamie has developed his own style of coaching, mixing fun with skill acquisition. All of the coaches with JSTA are fully qualified but also understand Jamie's way of sharing a love of the game. (Stafford 2012)

Jamie also shares his skills and experience with other tennis clubs. JSCD.ie was recently released, this is a portal for clubs to make contact with Jamie and learn how to grow and develop their business and tennis services. (Stafford 2012)

- Jamie brings 25 years coaching experience to you.
- Qualified With Tennis Ireland Level 2.
- National Tester with the Professional Tennis Registry.
- Coaching Ireland Coach Tutor (Coach To Coaches).
- Qualified Fitness Instructor with the NCEF & ITEC.

Jamie participated in the study as he believed there was a gap in the market for a solution such as this and that he would like to have a solution like this in his business.

4.3 Recruitment of Study Subjects

The recruitment of suitable study subjects was given to the study coach to find appropriate individuals for the two groups. The brief that was given to the Study Coach was to find 'typical' intermediate level club tennis players who wanted to improve their tennis game. All the subjects were either current or previous students of JSTA. The study coach came back with five suitable subjects for the Hybrid Group and four suitable subjects for the Web only group. All subjects had to agree to do both assessments, complete the questionnaire and feedback form and participate actively on the web site. All the subjects had the same overall goal of improving their game and were allowed to select one particular focus area for the study.

There were eight male subjects and one female (Subject 4). All subjects were aged between forty and fifty years of age.

The subjects were at the player level of proficiency required with a spread of subjects between the upper end of beginner (ITN 6 – 33%) through to good intermediate players (ITN 5 to ITN 4 – 45%) onto the lower end of advanced (ITN3 – 22%).

4.4 User Guide

The user guide (Appendix 2) was created to help the users access all the functionality of the system as it was not possible to show the application to the users face-to-face. It takes the users through most of the basic functionality they will need to make use of the system successfully.

4.5 Quantitative Methods

4.5.1 Questionnaire

The questionnaire for this study comprised of 14 background questions (see Appendix 1) to give context to the participating subjects. The idea behind the questionnaire is to understand how long the players have been playing tennis, their attitudes and knowledge and goals for their tennis game. The responses to the questions give us a deeper understanding of ITF ITN assessment results and put them in context.

All nine subjects completed the questionnaire before the initial ITF ITN assessment.

4.5.2 ITF ITN Assessment

The ITF (International Tennis Federation), the governing body of world tennis, has an internationally recognised assessment method for determining the performance levels of players – the ITN (International Tennis Number) (ITF 2012). The ITF ITN assessment system is explained in detail at the following link <http://www.tennisplayandstay.com/media/131803/131803.pdf> (ITF 2012), but in summary it breaks the game of tennis into five quantifiable domains comprising of:

- Ground Stroke Depth
- Ground Stroke Accuracy
- Volley Depth
- Serving
- Mobility

The first four domains are stroke based assessments and are further sub divided into sub areas as Backhand, Forehand and the ability to consistently hit certain designated areas of the tennis court. The fifth domain is around tennis court mobility and athleticism and comprises a speed and dexterity assessment.

The scoring system is straightforward, fair and easy to understand for coach and player as shown in the Figure 29 below.

International Tennis Number — On Court Assessment

Name: _____ Date of Birth: _____ Sex: M F
 Assessor: _____ Date: _____ Venue: _____

what's your number?



GS Depth			Volley Depth			GS Accuracy			Serve		
Stroke	#	Score	Stroke	#	Score	Stroke	#	Score	Stroke	#	Score
Forehand	1		Forehand	1		Forehand DL	1		1st Box Wide	1	
Backhand	2		Backhand	2		Backhand DL	2		1st Box Wide	2	
Forehand	3		Forehand	3		Forehand DL	3		1st Box Wide	3	
Backhand	4		Backhand	4		Backhand DL	4		1st Box Middle	4	
Forehand	5		Forehand	5		Forehand DL	5		1st Box Middle	5	
Backhand	6		Backhand	6		Backhand DL	6		1st Box Middle	6	
Forehand	7		Forehand	7		Forehand CC	7		2nd Box Middle	7	
Backhand	8		Backhand	8		Backhand CC	8		2nd Box Middle	8	
Forehand	9		Sub Total	Volley Depth Total	Consistency	Forehand CC	9		2nd Box Middle	9	
Backhand	10					Backhand CC	10		2nd Box Middle	10	
Sub Total						Forehand CC	11		2nd Box Wide	11	
Consistency						Backhand CC	12		2nd Box Wide	12	
GS Depth Total						Sub Total			Sub Total		
						Consistency			Consistency		
						GS Accuracy Total			Serve Total		

This ITN Assessment was conducted in accordance with the guidelines set forth in the Official ITN Assessment Guide. I hereby agree to its authenticity.

Signed by/belief of the player:

Signed by the Assessor:

Strokes Total	Mobility Score	Total Score

Mobility Table

Time	Score

T	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
S	1	2	3	4	5	6	7	8	9	10	11	12	12	14	15	16	18	19	21	26	32	39	45	52	61	76
Score (F)	57-79	80-108	109-140	141-171	172-205	206-230	231-258	259-303	304-344	345-430																
Score (M)	75-104	105-139	140-175	176-209	210-244	245-268	269-293	294-337	338-362	363-430																
ITN	ITN 10	ITN 9	ITN 8	ITN 7	ITN 6	ITN 5	ITN 4	ITN 3	ITN 2	ITN 1																

Number of Assessments	New ITN Rating

Circle players ITN level after completing the Assessment.

Figure 29 - ITN Assessment Form

4.5.3 ITF ITN Process in this Study

This study used the ITF ITN process as the backbone for the quantifiable element of the test of the research question determining the effectiveness of web-based learning in sport.

The methods, process and tools used to complete the ITF ITN Assessment were as follows:

- Court was laid out according to the instructions in the ITF ITN Assessment guidelines (see (ITF 2012))
- Three designated roles were involved in administering the Assessment under the direction of the Study Coach:
 - o The Feeder / Scorer was the Study Coach and called out the scores after each subjects shot
 - o The Marker recorded the subject's scores as called out by the Study Coach on the official ITN Assessment form (see Appendix 4).
 - o The Videographer used a camera to record all the subject assessments
- Study Coach explained process to each subject
- Each subject was given a warm up and instructions as per the ITF ITN Assessment guidelines (see (ITF 2012))
- Each assessment takes approximately 15 minutes
- At the end of the ITN assessment the Study Coach gets the subjects scores from the Marker and takes the subject through their scores. Out of this discussion the Study Coach gives the subject a focus area to work on over the duration of the study.
- Study Coach uploads assessment scores to subjects profile on web site
- Study Coach uses web site to assign program, including focus area, to subject to work on over the duration of the study
- Study Coach uploads video analysis of assessment via website to subjects profile
- Subject organises web chats with Study Coach using website
- Subject can view their assessment scores, video analysis and program on their profile page.

4.5.4 Website Usage

The My Tennis World website records some usage statistics of the subject activity on the site – see Figure 30 below:

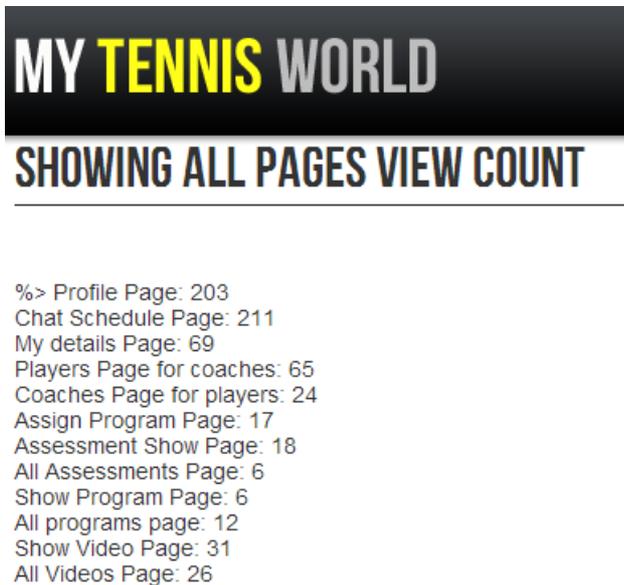


Figure 30 - Website Statistics

The website records activity on:

- All the Chat
- Video usage of generic content
- My Details
- Players Page for Coaches
- Coaches Page for Players
- Coach Assigning program
- Assessment Views
- All Assessments
- Show Program
- All Programs
- Show Video
- Show All Videos
- Log ins

4.6 Qualitative Methods

4.6.1 Feedback Form

The feedback form for this study comprised 8 questions (see Appendix 3). This form was completed once they had completed the final ITF ITN Assessment. This form gives valuable context to the process but this time at the end of the process rather than the questionnaire which is at the beginning of the process.

All nine subjects completed their feedback forms.

5 Results

5.1 Introduction

There were nine subjects in this study divided into two groups:

- Group 1
 - o Hybrid – On-court learning combined with Web learning
 - o 5 subjects – (1,2,5,7 and 9)
- Group 2
 - o Web Only – Web learning only
 - o 4 subjects (3,4,6,8)

The attrition rate was zero.

There were five sources of data for this study:

- Questionnaire
- ITF ITN Assessment 1
- Usage of Web Site
- ITF ITN Assessment 2
- Feedback form

There were four quantitative sources and one qualitative source. All subjects completed their assessments, questionnaire and forms and used the web site.

5.2 Quantitative Results

There were three elements to the Quantitative Results, the initial questionnaire, the assessments and the web usage statistics.

5.2.1 Questionnaire Results

5.2.1.1 Q1. What type of player are you?

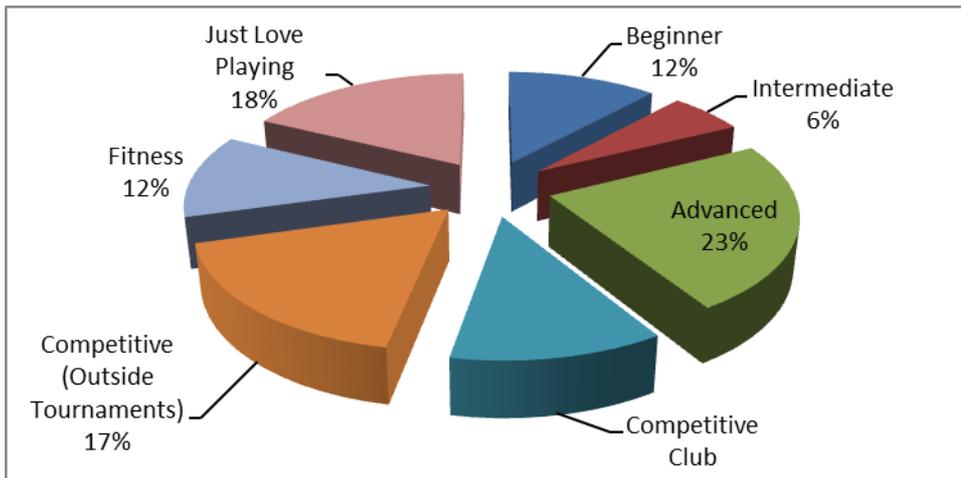


Figure 31 - Types of player

There was a good spread of players here from being on the high end of beginner to the low end of advanced.

5.2.1.2 Q2. How many years have you been playing Tennis?

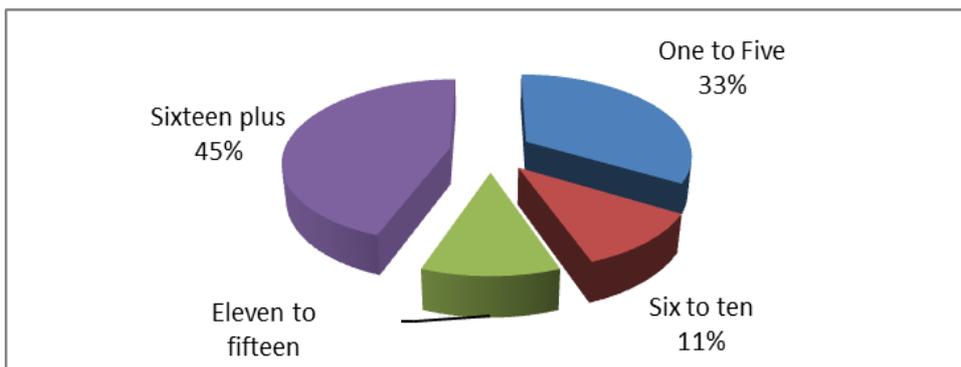


Figure 32 - Years playing tennis

There was a good spread again here reflecting the types of player in the previous Figure. Playing experience ranged from 3 to 30 years.

5.2.1.3 Q3. How long are you with your current club?

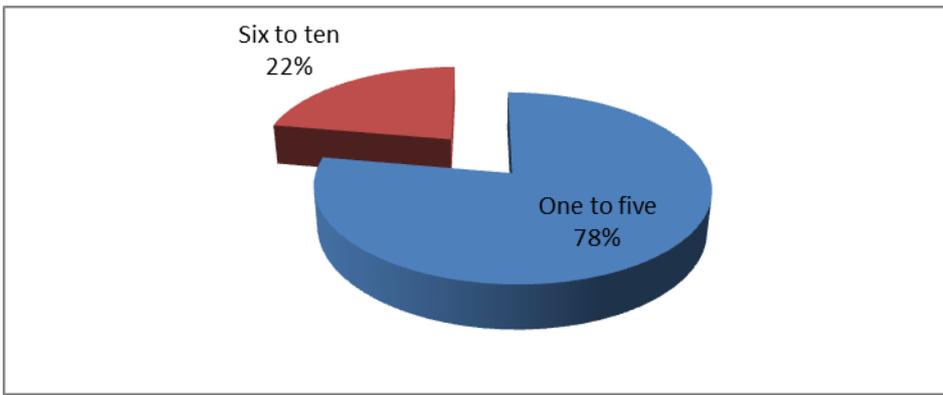


Figure 33 - Length of time at current club

This was surprising as 78% (n = 7) of the subjects were at new clubs even though the majority of the subjects (n = 6) had been playing tennis for more than six years. This could indicate dissatisfaction with previous clubs.

5.2.1.4 Q4. What Level do you play at?

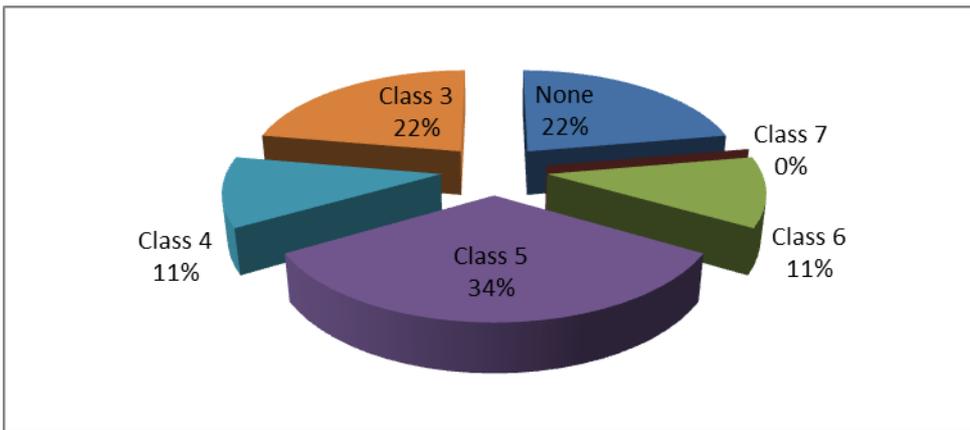


Figure 34 - Level of play

This correlates with the type of player they are. There is a good spread from Class 3 which is the lower end of advanced down to class 6 which is the high end of beginner.

5.2.1.5 Q5. Do you want to improve your game?

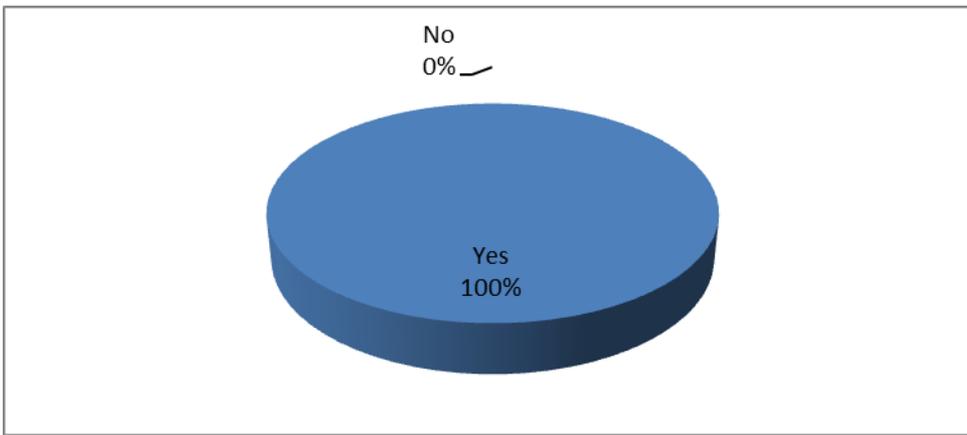


Figure 35 - Improve game

As expected all players indicated they wanted to improve their games. It would have been a surprise if they had not as they were all recruited through contact with the JSTA.

5.2.1.5.1 What do you do currently?

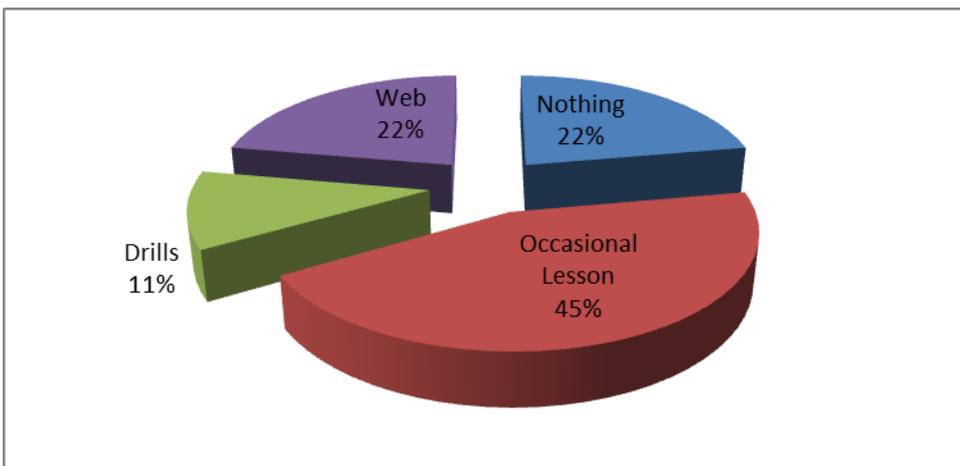


Figure 36 - How currently

This was an interesting result and may be useful in understanding the results of the quantitative tests comparing hybrid to web-only. None of them were taking regular coaching. 45% (n = 4) of them were taking the occasional lesson and 22% (n = 2) were doing nothing.

5.2.1.5.2 *Happy with results?*

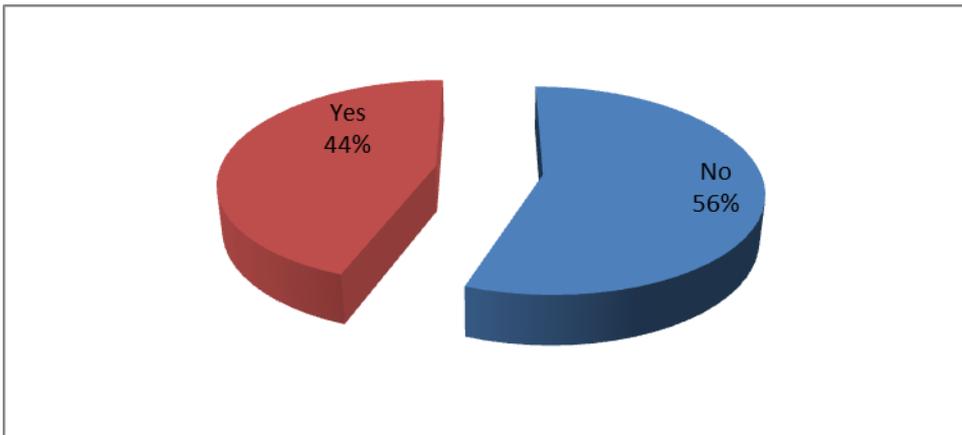


Figure 37 - Happy with results?

56% (n = 5) of the respondents were not happy with their results in improving their performance.

5.2.1.5.3 *Would you like to do more?*

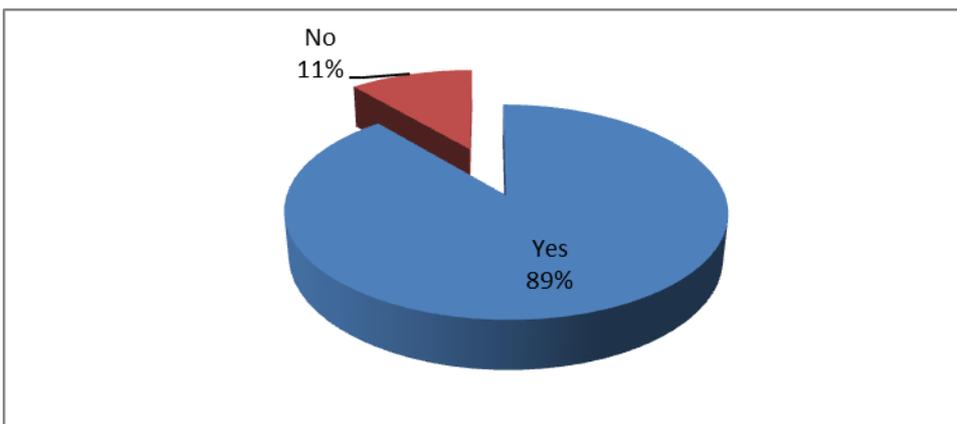


Figure 38 - Do more?

89% (n = 8) of the subjects wanted to do more to improve their performance.

5.2.1.5.4 If yes, why don't you?

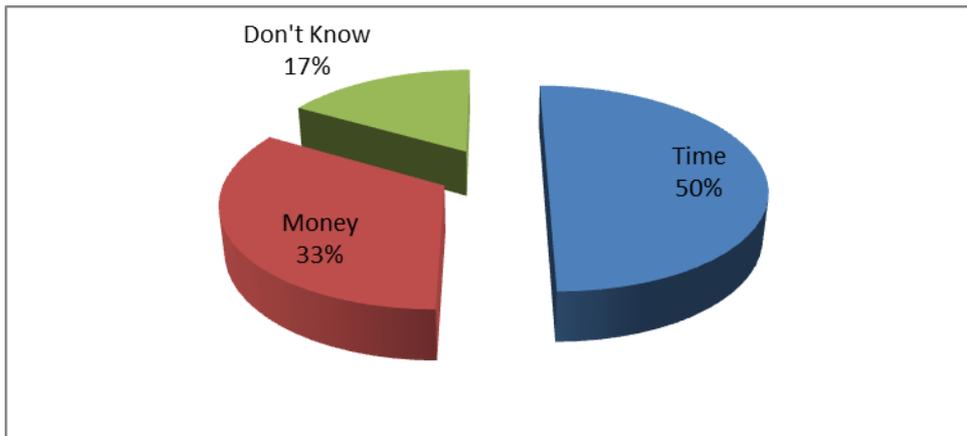


Figure 39 - Why don't you?

Time and Money made up 83% of the reason why they didn't do more.

5.2.1.6 Q6. How did you choose your current racket?

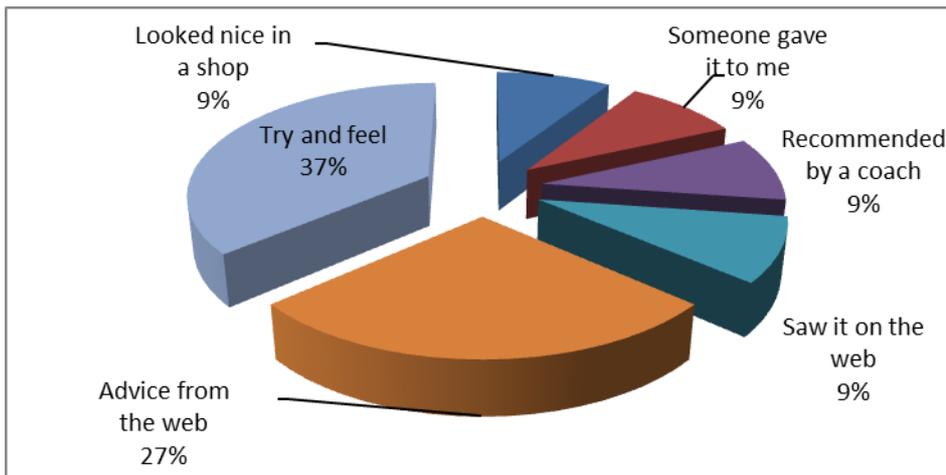


Figure 40 - How did you choose your current racket?

The more experienced players used a combination of try and feel and advice from the web to choose their racket.

5.2.1.7 Q7. Does your current racket suit your game?

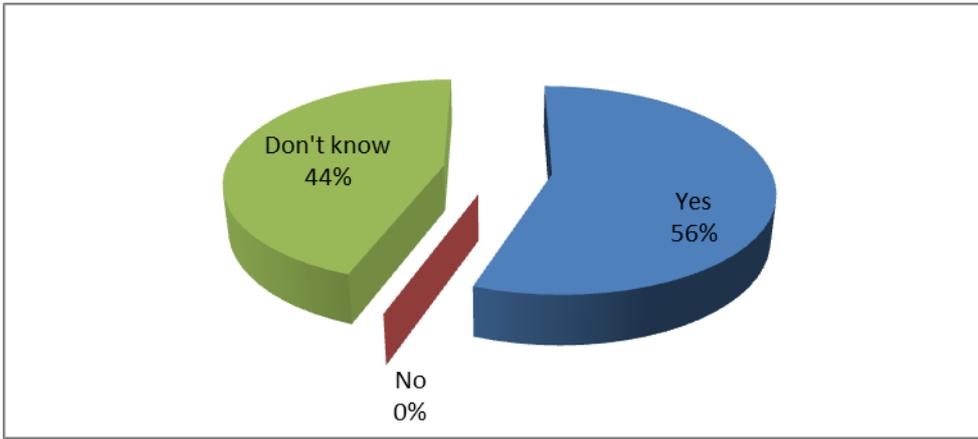


Figure 41 - Racket suit your game?

44% (n = 4) of the subjects didn't know if their racket suited their game or not which indicates a lack of knowledge of tennis equipment.

5.2.1.7.1 Interested in finding out more?

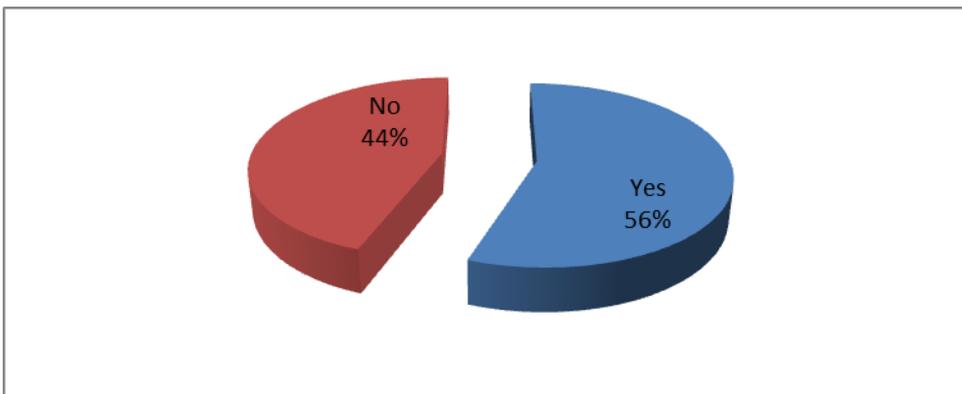


Figure 42 - Interested in finding out more?

5.2.1.8 Q8. Do your strings suit your game?

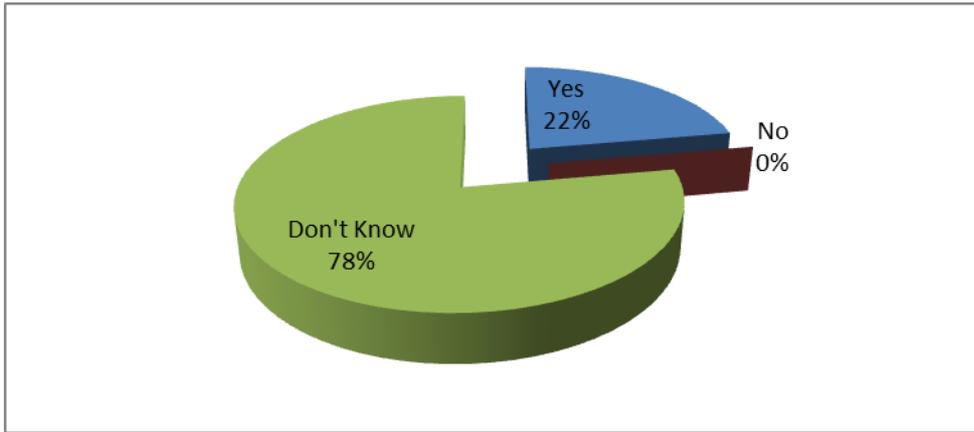


Figure 43 - Strings suit your game?

This highlights the fact even more that the subjects, even the experienced ones, weren't sure if their strings suited their game and highlighted a basic lack of knowledge of tennis equipment.

5.2.1.8.1 Do you know the tension in your racket?

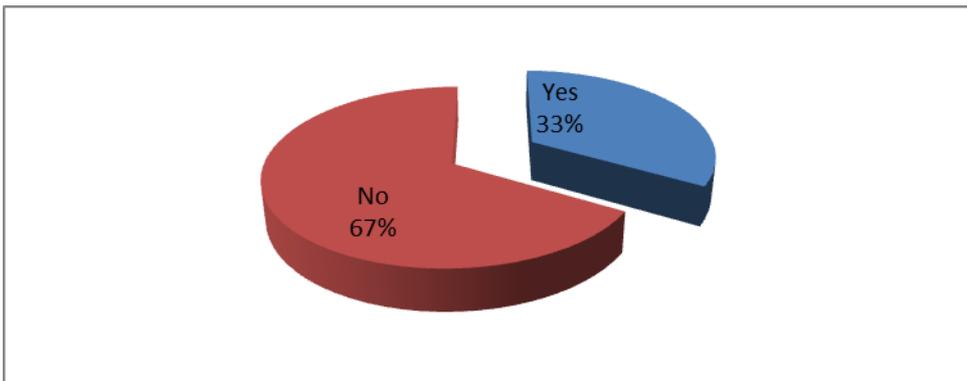


Figure 44 - Know string tension in racket?

67% (n = 6) of the subjects didn't know the tension of the strings in their racket which again indicates a lack of tennis equipment knowledge.

5.2.1.8.2 Would you like to know more?

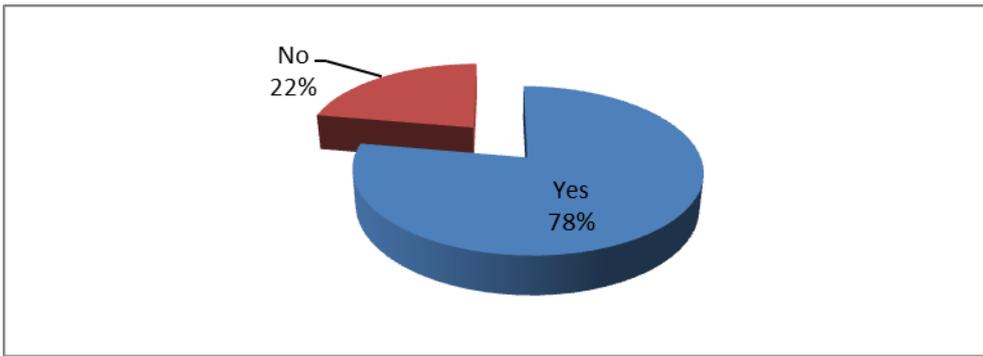


Figure 45 - Like to know more?

5.2.1.9 Q9. Are you happy with your current understanding of Tennis tactics?

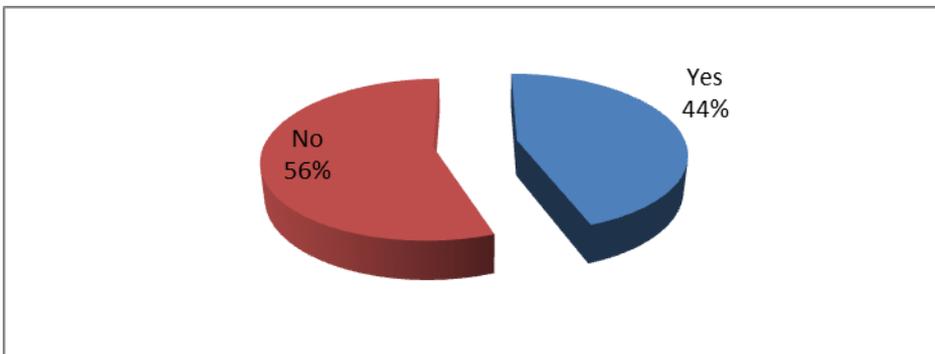


Figure 46 - Happy with understanding of tennis tactics

5.2.1.9.1 Interested in learning more?

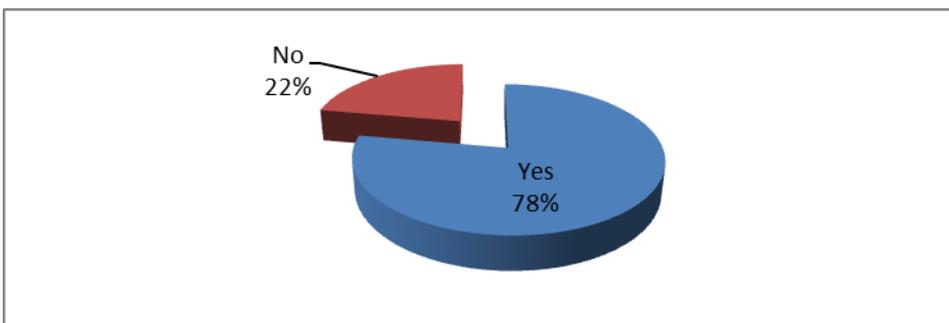


Figure 47 - Interested in learning more?

Tennis tactics was another area that players felt that they needed to do more (78%).

5.2.1.10 Q10. Have you ever used the web for any of the above activities?

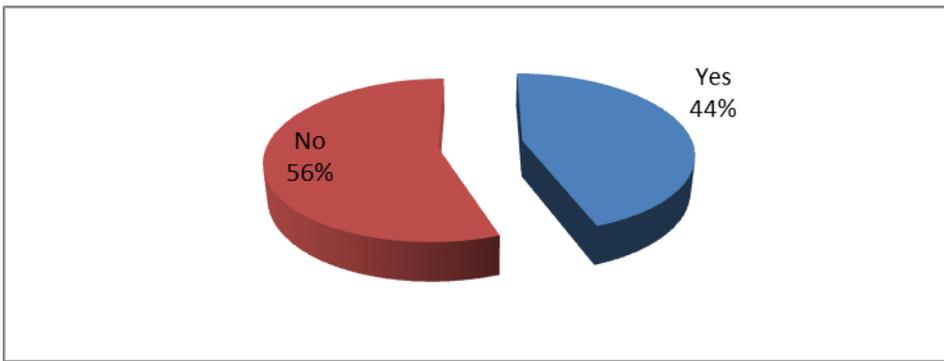


Figure 48 - Ever used web for these activities?

Interesting here in that 44% (n=4) of them were already using the web for tennis related activities.

5.2.1.11 Q11. Would you use a website that had all this information in one place plus coaching and a social networking element to exchange ideas / issues / improve your game arrange matches etc.?

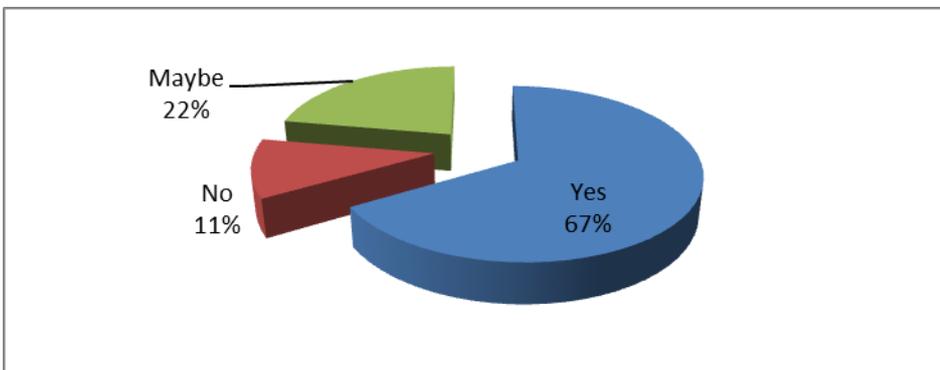


Figure 49 - Use this website?

Only 11% - one subject said they wouldn't use a site such as this.

5.2.1.12 Q12. What would be the most interesting feature of such a website?

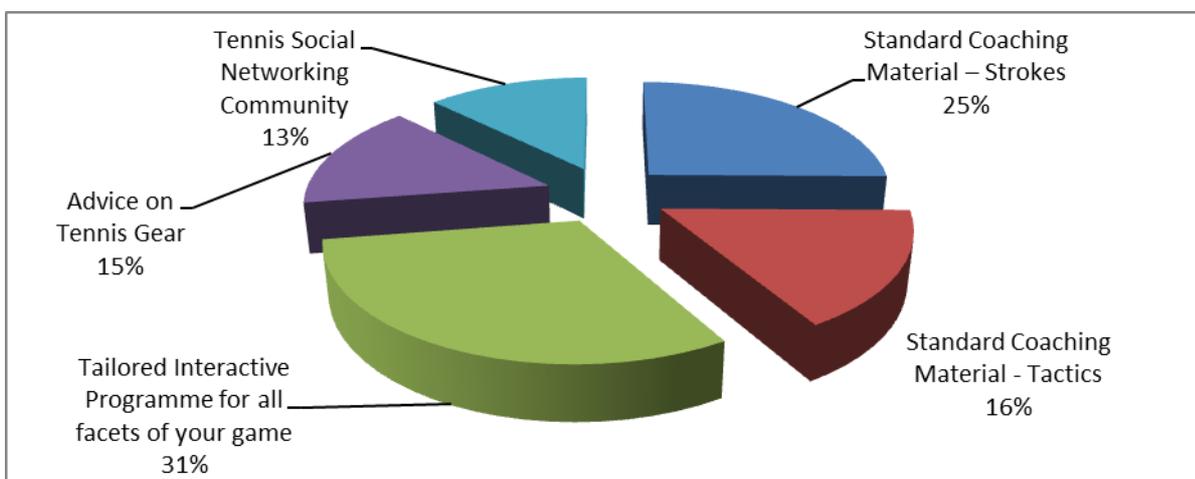


Figure 50 - Interesting features of website

The tailored interactive program was the most highly rated feature the subjects would want in a site like this.

5.2.1.13 Q13. Would you pay for web based coaching and advice?

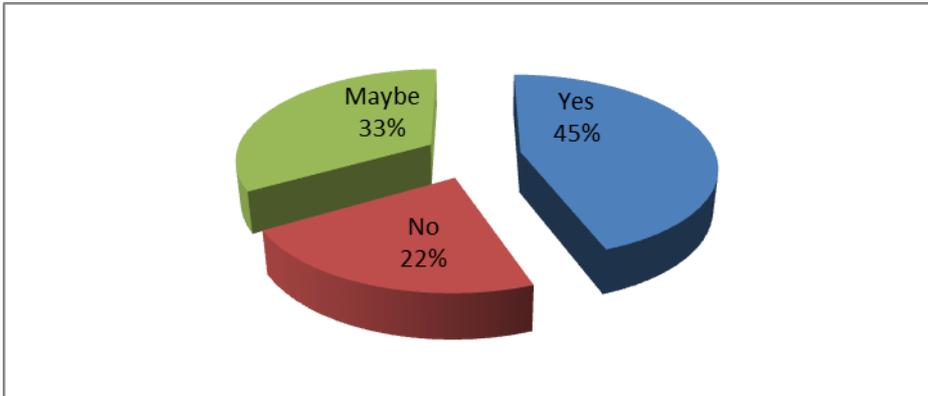


Figure 51 - Pay for site?

78% (n=7) of the subjects said they might or would pay for a service such as this.

5.2.1.14 Q14. Do you like the idea of a Social Network where you can share experiences, content etc...? with your peers both locally and internationally?

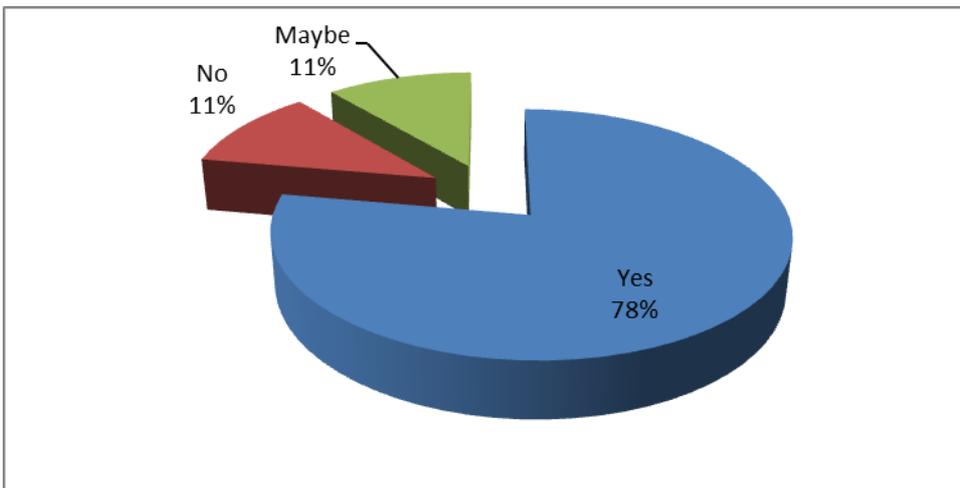


Figure 52 - Social Network?

Interestingly 78% (n = 7) were in favour of social networking as a part of the experience but was the least favourite (13%) as a feature when ranked against the other features of a site such as this.

5.2.2 Individual ITF ITN Assessment Results

As explained in section 4 “Evaluation” of this document each subject took an initial ITF ITN Assessment at the beginning of the process on the 24/11/12 and then after completing the process took a second ITF ITN Assessment approximately four weeks later on the 29/12/12.

Conditions were identical for both assessments:

- Assessments were carried out at Sportsco in Ringsend
- On Saturday’s between 10 A.M and 1 P.M.
- Study Coach leading assessments on both days
- Same weather conditions. Mostly dry with some intermittent wind
- Same balls – Tretorn
- Court Surface – Tiger Turf
- Court State – Wet and Sandy

There were nine subjects involved in this study. Some abbreviations are used in the Figures below and the following is a brief explanation as to their meaning:

- GS Depth (Ground Stroke Depth): Total number of points gained in Ground Stroke Depth element of the ITF ITN Assessment. The aim in this element of the assessment is to have the balls first bounce be in court but as close to the base line as possible and then for the second bounce to clear the double bonus line.
- V Depth (Volley Depth): Total number of points gained in Volley Depth element of the ITF ITN Assessment. The aim in this element of the assessment is to have the balls first bounce be in court but as close to the base line as possible and then for the second bounce to clear the double bonus line.
- GS A (Ground Stroke Accuracy): Total number of points gained in the Ground Stroke Accuracy element of the ITF ITN Assessment. The aim in this element of the assessment is to hit the ball into a specific target area on the court. If the balls first bounce enters this target area then bonus points are gained by the depth i.e. proximity to the baseline and second bounce clearing the double bonus line.
- Serve: Total number of points gained in the Serve element of the ITF ITN Assessment. The aim in this element of the assessment is to hit the ball into a specific target area on the court. If the balls first bounce enters this target area then bonus points are gained by the second bounce clearing the double bonus line.
- Strokes: Total number of points gained in the GS Depth, V Depth, GS A and Serve elements of the ITF ITN Assessment
- Mobility: Total number of points gained in the Mobility element of the ITF ITN Assessment. This involves picking up five balls in five different areas of the court and bringing them back to a central point on the baseline. This is a timed assessment; the faster the assessment is done the higher the score.
- Total: Total number of points scored. Combination of the Strokes total and the Mobility total.

5.2.2.1 Group 1 - Hybrid Group

All subjects in this Group had a combination of traditional on-court training and using the web learning tool.

5.2.2.1.1 Subject 1

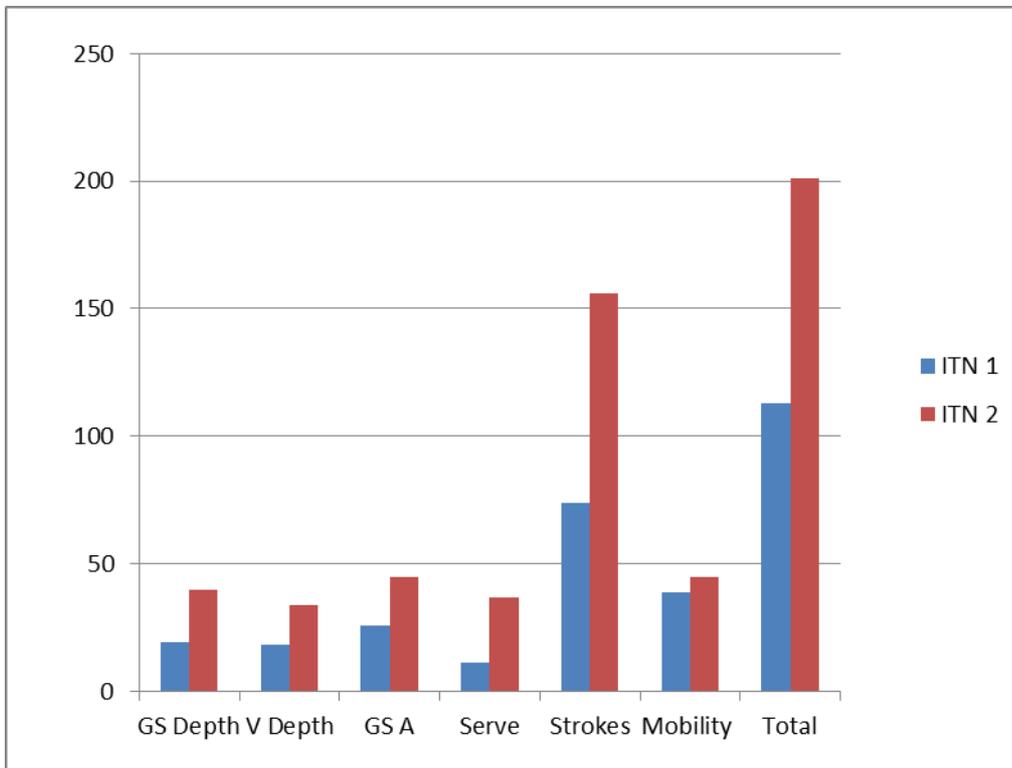


Figure 53 - Subject 1 ITF ITN Assessment Results

Subject 1 improved in all areas from ITN 1 to ITN2. The overall improvement in performance by Subject 1 from ITN1 to ITN2 was 77%. This was the largest percentage improvement of any of the subjects. This may be explained by the fact that he was relatively new to playing tennis (3 years playing), had the lowest initial score of any of the subjects, was athletic / sporty in other domains and was very receptive to instruction. Subject 1's focus area was the serve and the improvement in this domain was even more significant at 236%. This again was the largest percentage improvement of any of the subjects. The subject moved from having an ITF ITN rating of 9 to a rating of 7.

5.2.2.1.2 Subject 2

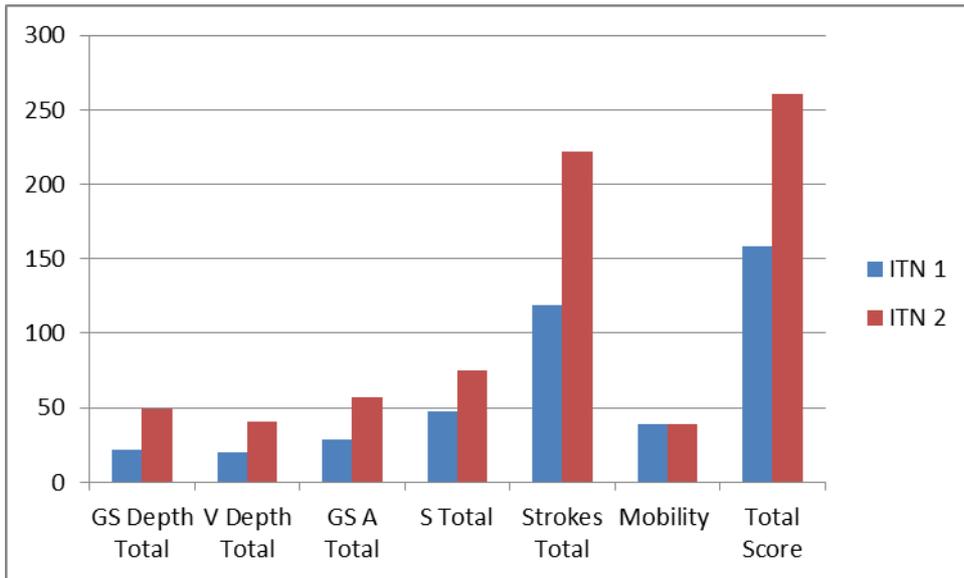


Figure 54 - Subject 2 ITF ITN Assessment Results

Subject 2 improved in all areas with the exception of Mobility which stayed the same from ITN 1 to ITN2. The overall improvement in performance by Subject 2 from ITN1 to ITN2 was 65%. This subject had the highest score of any of the subjects and was the most proficient tennis player in the study. Subject 2's focus area was the volley and the improvement in this domain was even more significant at 105%. This subject actually improved to a greater extent in the GS Depth area with an improvement of 122%. The subject moved from having an ITF ITN rating of 8 to a rating of 5 (the highest rating of any of the subjects).

5.2.2.1.3 Subject 5

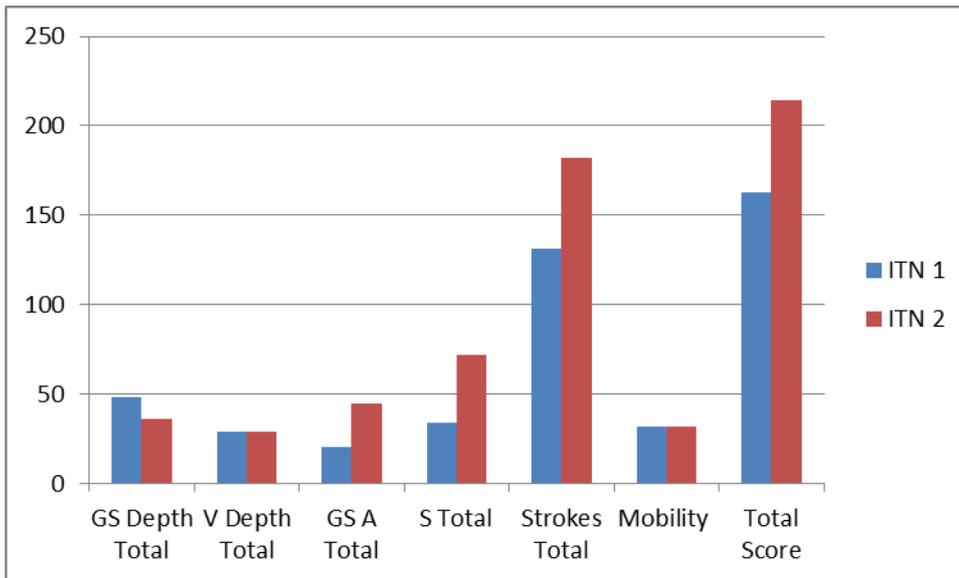


Figure 55 - Subject 5 ITF ITN Assessment Results

Subject 5 improved in all areas with the exception of Mobility and Volley Depth which stayed the same and Ground Stroke Depth which degraded from ITN 1 to ITN2. The overall improvement in performance by Subject 5 from ITN1 to ITN2 was 31%. Subject 5's focus area was the serve and the improvement in this domain was even more significant at 111%. This subject actually improved to a greater extent in the Ground Stroke Accuracy area with an improvement of 125%. The subject moved from having an ITF ITN rating of 8 to a rating of 6.

5.2.2.1.4 Subject 7

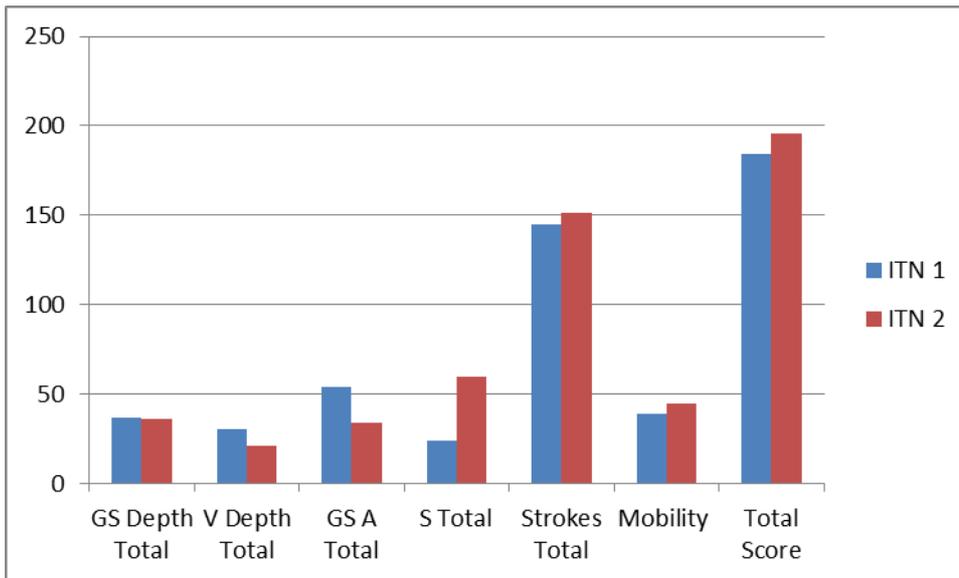


Figure 56 - Subject 7 ITF ITN Assessment Results

Subject 7's performance degraded in three of the four Strokes domains (Ground Stroke Depth, Volley Depth and Ground Stroke Accuracy) and improved in the Serve and Mobility areas from ITN 1 to ITN2. The overall improvement in performance by Subject 7 from ITN1 to ITN2 was 6%. This was by far the lowest percentage increase in performance by any of the nine subjects on the study. Subject 7's focus area was the serve and the improvement in this domain was more significant at 150%. The subject actually was delighted at the result as the subject stated that the Serve had always been a problem for them over the years and they believe that this process had fixed it. They also stated that they believed they could bring their other scores back up as they had focussed completely on the Serve during this study. The subjects ITF ITN rating of 7 remained unchanged after the study. This was the only subject not to improve their ITF ITN rating during the study.

5.2.2.1.5 Subject 9

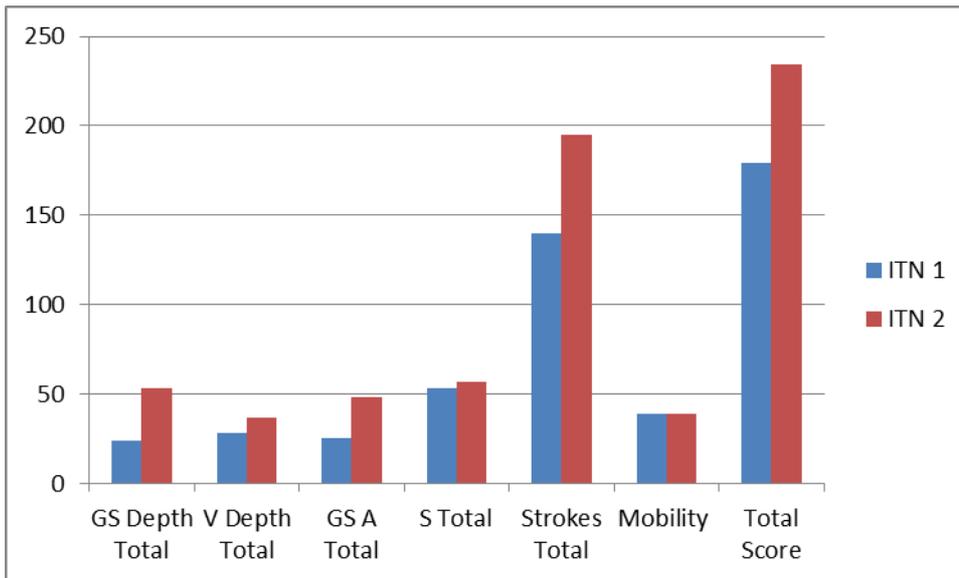


Figure 57 - Subject 9 ITF ITN Assessment Results

Subject 9 improved in all areas with the exception of Mobility which stayed the same from ITN 1 to ITN2. The overall improvement in performance by Subject 9 from ITN1 to ITN2 was 30%. Subject 9's focus area was Ground Stroke Depth and the improvement in this domain was even more significant at 120%. The subject was happy with the result as they were very disappointed after their first assessment with their Ground Stokes which they believed to be very good. The subject moved from having an ITF ITN rating of 7 to a rating of 6.

5.2.2.2 Group 2 – Web Only Group

5.2.2.2.1 Subject 3

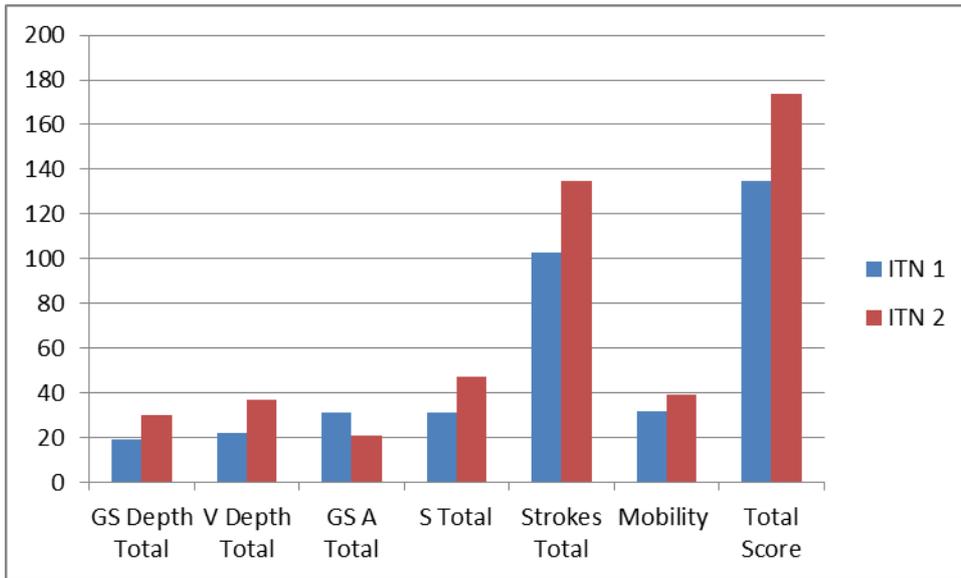


Figure 58 - Subject 3 ITF ITN Assessment Results

Subject 3 improved in all areas with the exception of GS Accuracy which degraded and Mobility which stayed the same from ITN 1 to ITN2. The overall improvement in performance by Subject 3 from ITN1 to ITN2 was 28%. Subject 3’s focus area was Ground Stroke Depth and the improvement in this domain was more significant at 57%. The subject actually had a greater improvement in the Volley Depth domain with an increase in performance of 68%. The subject moved from having an ITF ITN rating of 9 to a rating of 8.

5.2.2.2.2 Subject 4

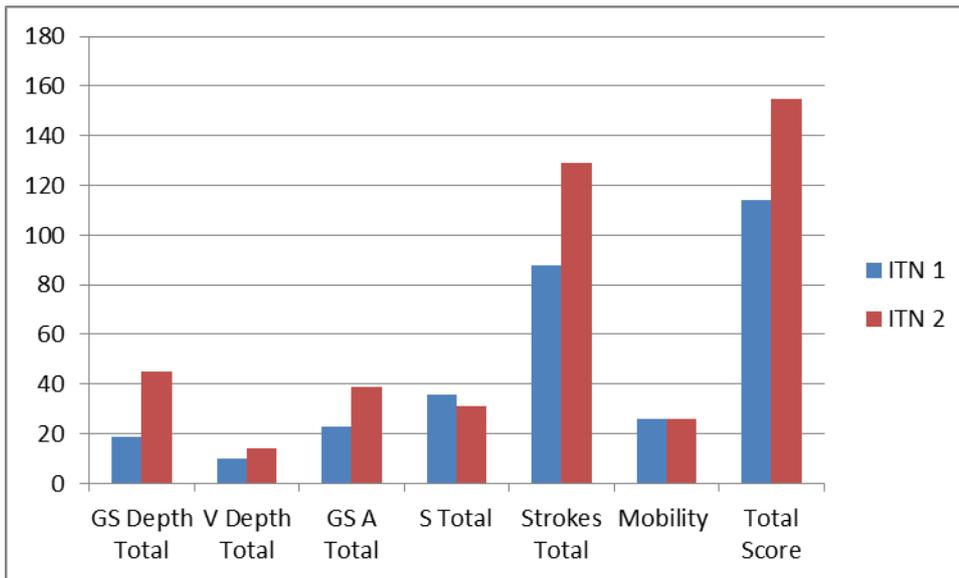


Figure 59 - Subject 4 ITF ITN Assessment Result

Subject 4 improved in all areas with the exception of Serve which degraded and Mobility which stayed the same from ITN 1 to ITN2. The overall improvement in performance by Subject 4 from ITN1 to ITN2 was 35%. Subject 4's focus area was Volley Depth and the improvement in this domain was 40%. The subject actually had a greater improvement in the Ground Stroke Depth domain with an increase in performance of 136%. The subject moved from having an ITF ITN rating of 8 to a rating of 7.

5.2.2.2.3 Subject 6

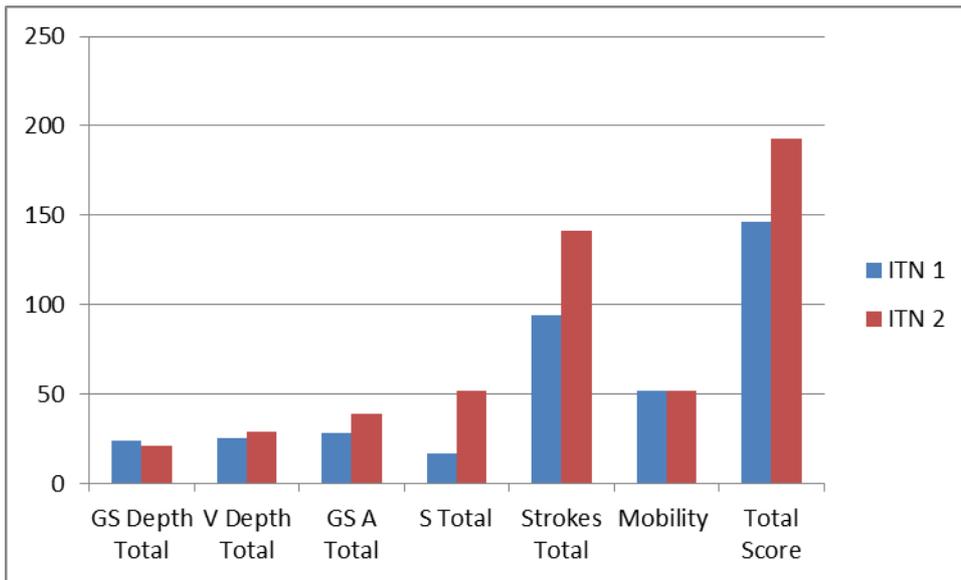


Figure 60 - Subject 6 ITF ITN Assessment Results

Subject 6 improved in all areas with the exception of Ground Stroke Depth which degraded and Mobility which stayed the same from ITN 1 to ITN2. The overall improvement in performance by Subject 6 from ITN1 to ITN2 was 32%. Subject 6's focus area was the serve and the improvement in this domain was more significant at 205%. The subject moved from having an ITF ITN rating of 8 to a rating of 7.

5.2.2.2.4 Subject 8

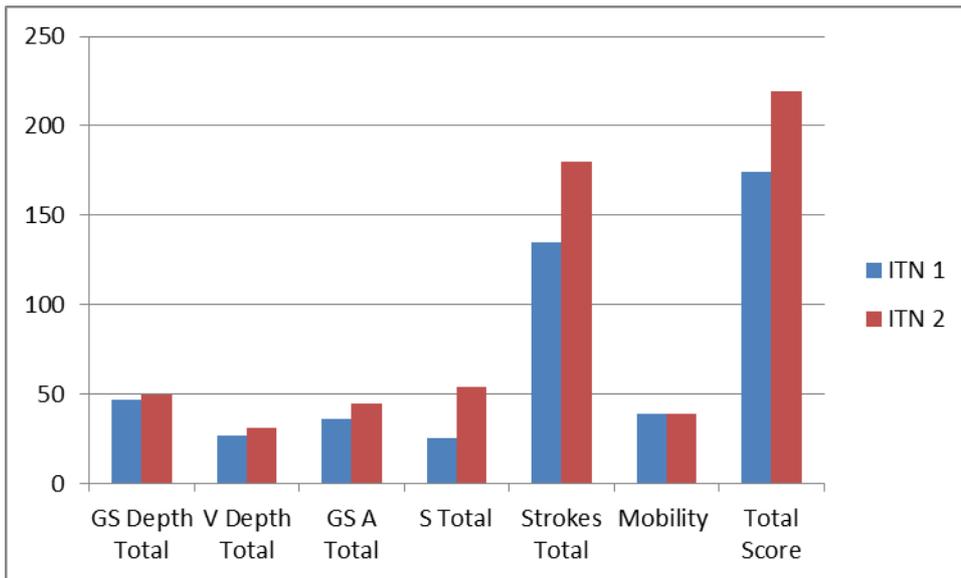


Figure 61 - Subject 8 ITF ITN Assessment Results

Subject 8 improved in all areas with the exception of Mobility which stayed the same from ITN 1 to ITN2. The overall improvement in performance by Subject 8 from ITN1 to ITN2 was 25%. Subject 8's focus area was the Serve and the improvement in this domain was more significant at 116%. The subject moved from having an ITF ITN rating of 8 to a rating of 6.

5.2.3 ITF ITN Assessment Summary

5.2.3.1 ITF ITN Elements

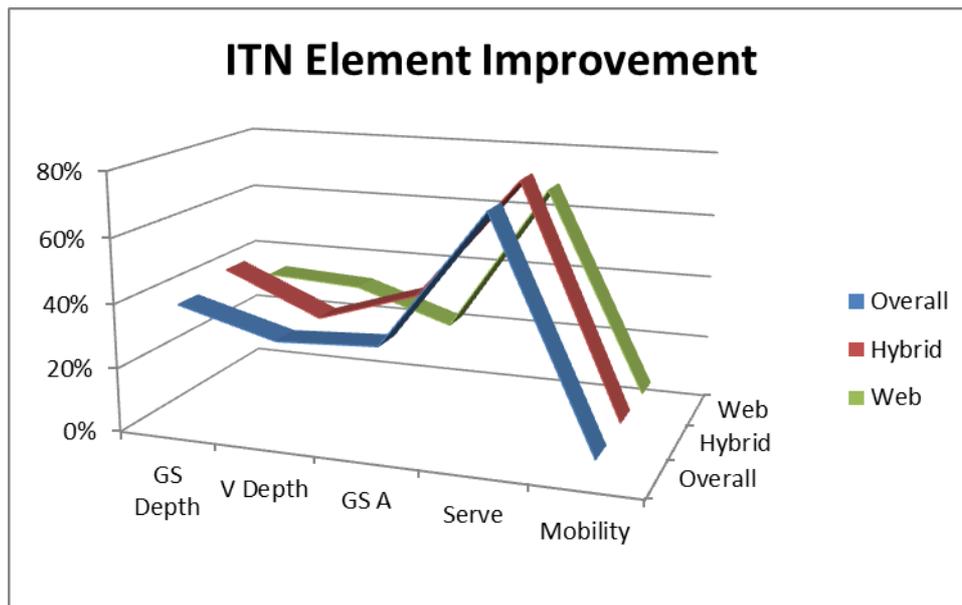


Figure 62 - ITF ITN Elements

There are five elements to the ITF ITN assessment. Overall the strokes element of the assessment was relatively consistent in their performance improvement with Ground Stroke Depth (39%), Volley Depth (31%) and Ground Stroke Accuracy (32%). The one area that showed the most improvement over the other strokes was the Serve (74%). The area that showed very little improvement was Mobility (5%).

The explanation for the more significant improvement in the performance of the Serve can be explained first of all by the fact that it is the one shot in tennis the subject has complete control over, all other shots are subject to movement and the influence of the other player and the movement of the ball. Secondly five of the subjects chose the Serve as their area of focus which would have driven the improvement levels up.

The explanation for the lack of improvement in mobility is firstly it is hard to improve your speed of movement significantly in such a short time (4 weeks) and secondly nobody focused on it for their improvement during the study.

Group	GS Depth	V Depth	GS A	Serve	Mobility
Overall	39%	31%	32%	74%	6%
Hybrid	43%	30%	40%	77%	6%
Web Only	34%	32%	22%	69%	5%
Difference	+9%	-2%	+18%	+8%	+1%

Table 6 - ITF ITN Element Improvement

The results regarding Hybrid approach versus Web Only are very interesting. The difference between them is much less than was expected. Taking these results from this study it intimates that the on-court activities in conjunction with the web activities only added a 9% performance improvement for Ground Stroke Depth, 18% performance improvement for Ground Stroke Accuracy and 8% performance improvement and actually showed a degradation in performance for the Volley Depth (-2%).

5.2.3.2 Overall Improvement

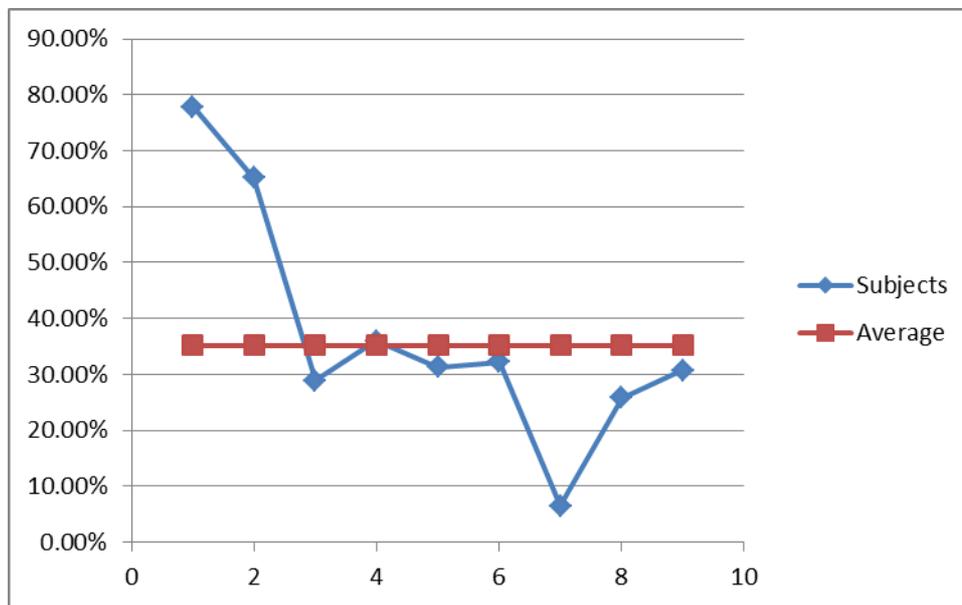


Figure 63 - Overall Improvement

The average level of performance improvement across the nine subjects was 35%.

5.2.3.3 Hybrid Group Improvement

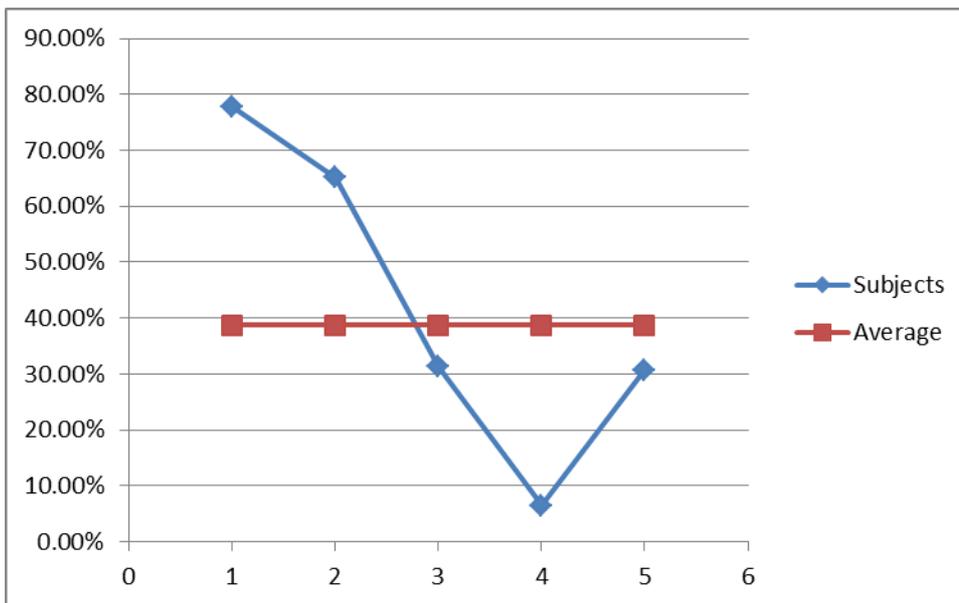


Figure 64 - Hybrid Group Improvement

The hybrid group improved by 39% which indicates that the combination of on-court coaching plus web-based coaching increases the learning effectiveness. In this study the improvement of the hybrid group over the overall average was another five percentage points and as we will see from the Figure 42 below the improvement over the web only coaching group (30%) was nine percentage points.

The deviation in scores between the five subjects was quite high and I think a much larger sample size is required to validate these findings.

In order to check whether the observed improvement in scores is statistically significant, a series of resampling analyses was performed with the support of my supervisor. This statistical procedure estimates the likelihood of the observation under randomisation assumptions.

As can be seen from Table 7 the total score as well as all but one of the sub-scores reached statistical significance. In other words, it is highly unlikely that the perceived change in scores is based on random variation of the data and we can assume that learners indeed improved in performance.

Table 7 - Resampling Analysis

Score	Pre- Assessment	Post- Assessment	Mean Change (%)	P
GS Depth	28.78	40.00	57.1%	.0281*
V Depth	23.22	30.33	37.2%	.0250*
GS A	31.33	41.44	44.0%	.0435*
Serve	31.00	53.89	102.4%	.0055*
Strokes	114.33	165.67	49.0%	.0021*
Mobility	37.44	39.56	5.8%	.1256
Total	151.78	205.22	37.2%	.0016*

When splitting the data further into hybrid and web only groups, the improvement in Total score is no longer significant ($p \leq .22$). Due to the small sample size it is no longer possible to infer whether the hybrid group improved more than the web only group or whether the difference is just due to random variance.

The differential between the web only group and the hybrid group was less than anticipated. A differential in performance of 9% indicates that the on-court activities only added a 9% increase in performance.

5.2.3.4 Web-Only Group Improvement

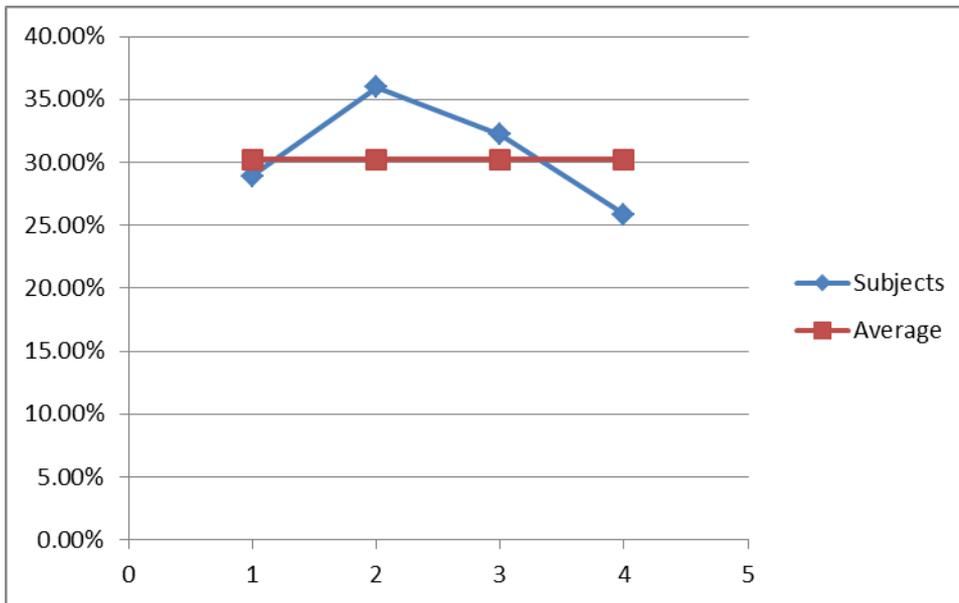


Figure 65 – Web-Only Group Improvement

As discussed above the improvement in performance of the Web-Only Group was 30%. Whilst this is nine percentage points behind the Hybrid Group it is still very relevant and shows that learner did improve. Also the deviation in results was small in comparison to the Hybrid group (see Figure 43 above), which may indicate that Web only based learning is a more consistent method of learning and may result in a more consistent improvement in performance. This compares favourably with the findings of (Fletcher 2001) who observed improvements in performance of 33%.

5.2.3.5 Focus All

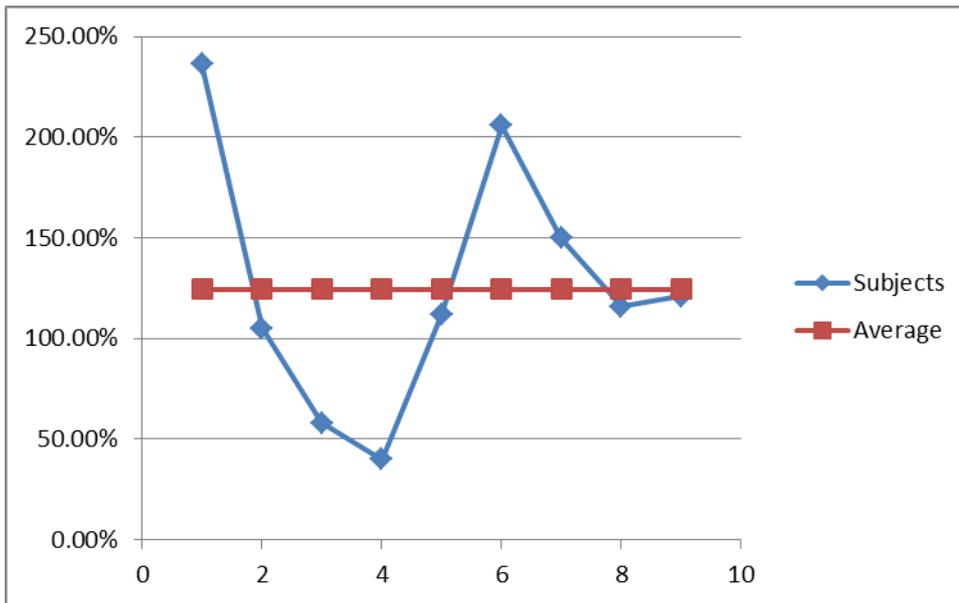


Figure 66 - Focus All

As part of the ITF ITN assessment process after the first assessment each subject was given a focus area to work on. The coach then assigns them a specific program to improve that particular skill. These specific focused skill areas showed even more significant levels of improvement than the overall level. Whilst some improvement over the overall improvement was to be expected the levels achieved were not. The average was a 124% improvement across all nine players in their focus area, which compares to a 35% improvement in their overall score. The deviation in focus area scores was significant with a high of 236% ranging down to a 'low' of 40%.

5.2.3.6 Focus Hybrid Group

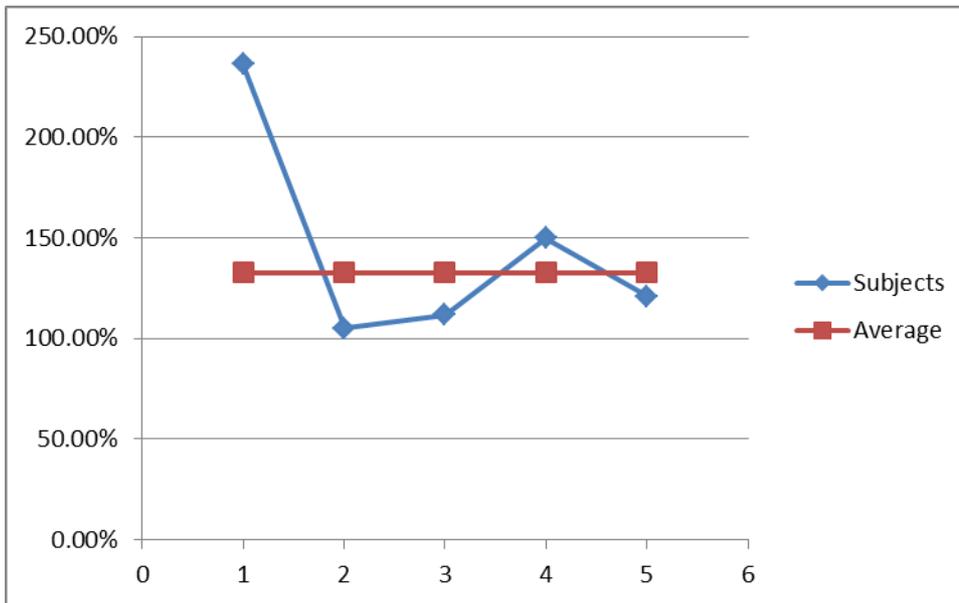


Figure 67 - Focus Hybrid Group

As discussed in the 'Focus All' section, each subject is given a focus area and the overall average for all nine players was 124%. For the subjects in the Hybrid group the performance was even more significant with an average improvement in focus area of 133%.

5.2.3.7 Focus Web-Only Group

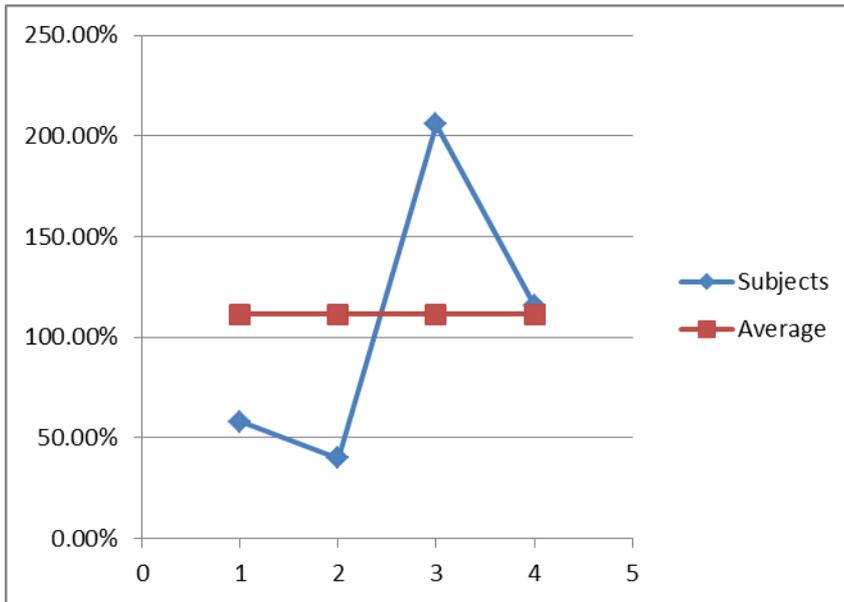


Figure 68 - Focus Web-Only Group

As discussed in the ‘Focus All’ section, each subject is given a focus area and the overall average for all nine players was 124%. For the subjects in the Web-Only group the performance was 111%. Again this shows that whilst significant gains were attained using a Web-Only approach, a Hybrid approach seems to result in a superior overall result. Interestingly and in contradiction to the Web-Only Overall assessment results there is no consistency in the percentage improvement of the Focus Web-Only group. This may indicate that the web is consistent in its effectiveness for overall improvement but that not so for specific focus areas.

5.2.4 Web Site Usage Statistics

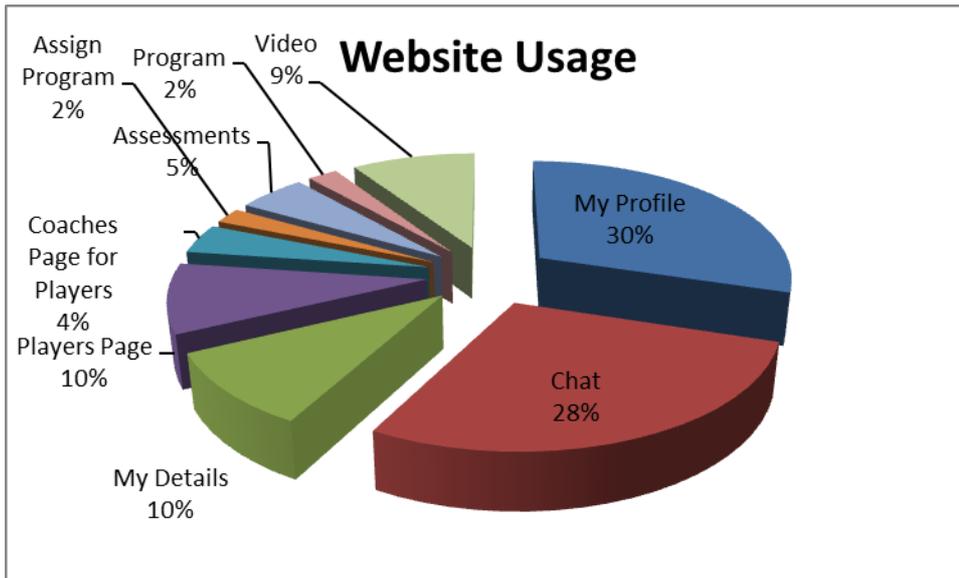


Figure 69 - Website Usage

As part of the quantitative research in this study website usage statistics were captured for key areas of the site. There were no surprises in the statistics as the two main areas of the site “My Profile” and “Chat” captured 58% of the traffic between them.

Table 8 - Website Page Usage Statistics

<i>My Profile</i>	<i>Chat</i>	<i>My Details</i>	<i>Players</i>	<i>Video</i>	<i>Assessments</i>	<i>Coaches</i>	<i>Program</i>	<i>Assign Program</i>	<i>Total</i>
238	224	79	75	74	41	32	18	17	798
30%	28%	10%	10%	9%	5%	4%	2%	2%	100%

5.2.4.1 My Profile

The “My Profile” page accounted for 30% (the highest) of the traffic on this website. This was to be expected as a subject can see their:

- Latest Assessment Scores
- Latest Program
- Latest Video

From this page they get a complete snapshot of where they are as a player. They then have the ability to drill down into more detail on previous assessment scores, programs and videos.

5.2.4.2 Chat

The “Chat” page was the second most used area of the site at 28%. Again this is not surprising as the subjects can schedule chats, attend chats and look at recordings of previous chats.

5.2.4.3 Video

At first it was surprising to see Video with only 9% of the traffic especially based on the qualitative feedback received. However most subjects were accessing their first assessment and this could be viewed on the “My Profile” page without having to go into the “Video” page. The subsequent videos of on-going work the subjects were doing or their final assessment were only available after the process was over.

5.2.4.4 Assessments

Again at first it was surprising to see the “Assessment” pages only accounted for 5% of the traffic. However it was a similar story to the Video area. The latest assessments were visible on the “My Profile” page and the final assessments were only uploaded at the end of the process.

5.2.4.5 Logins

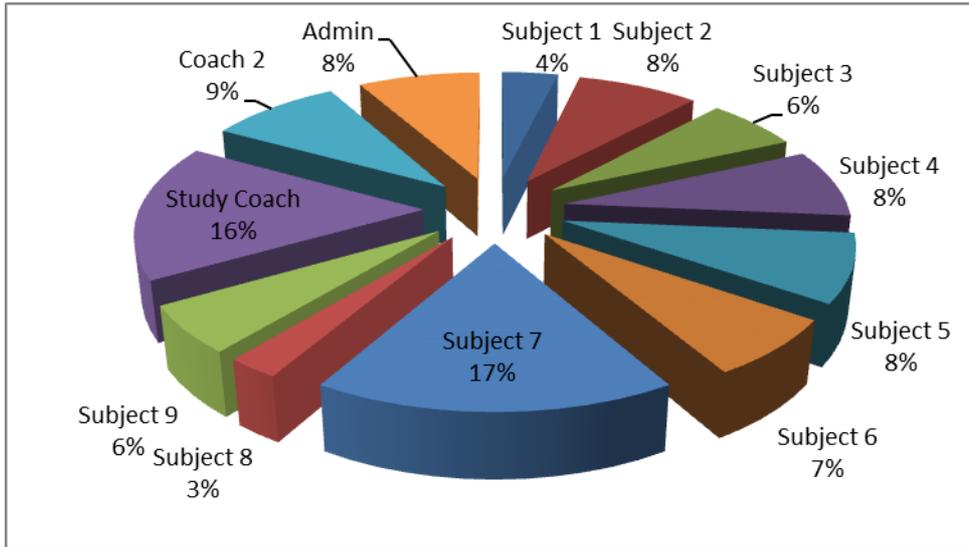


Figure 70 - Website Login Statistics

The website had 159 logins during the study. There were nine subjects, two coaches and an admin account active on the site. The average number of logins per user was 13, with a high of 27 logins (Subject 7) and a low of four logins (Subject 8).

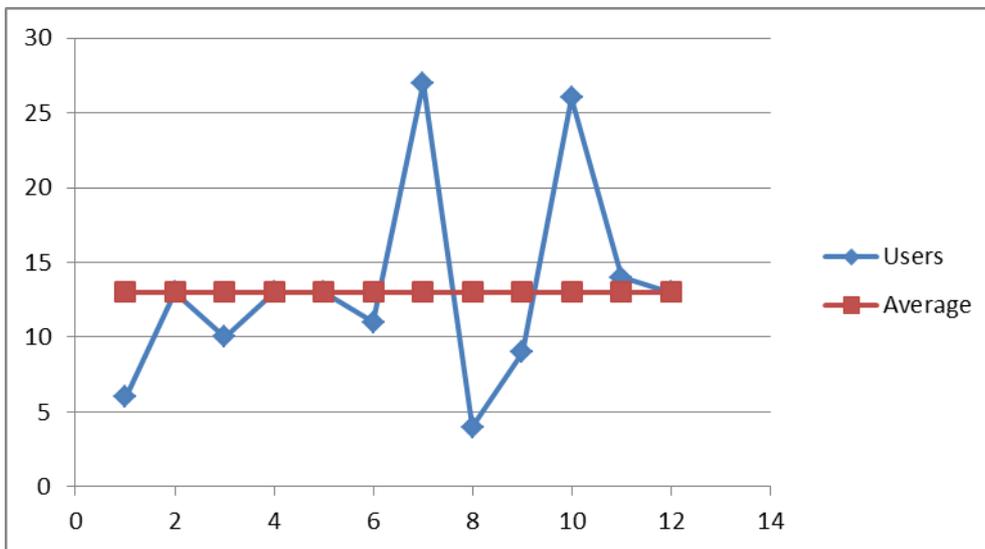


Figure 71 - Website Logins average graph

In the chat area of the website it was possible to see who was logged in at any one time and available for chat and there was always at least 55% (n = 5) of the subjects on line during the periods of 19.00 to 23.30. Another observation was that subjects seemed to leave the site logged in for days and on their desktop and dipping in and out of when they had time.

Interestingly website logins and activity were no guide to the level of overall improvement a subject would have in their final assessment. The subject with the highest number of logins (Subject 7) only increased performance by 6%, whilst the subject with the lowest number of logins (Subject 8) improved performance by 25%. However to caveat this Subject 7's focus area was the Serve and that increased by 150% in performance and in the feedback data he indicated that he had only focused on Serve and had done nothing on the rest of his game and was happy with the result.

5.3 Qualitative Results

5.3.1 Feedback Form Results

The feedback form was made up of eight questions.

5.3.1.1 Q.1 What was the best thing about the process?

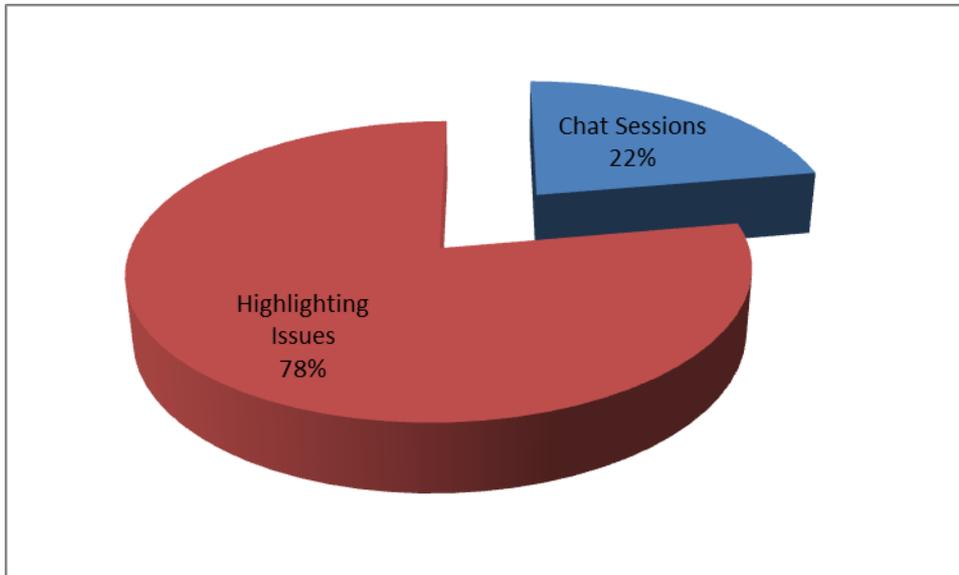


Figure 72 - Best thing about the process

The best thing about the process according to the nine subjects was the ability to watch themselves on Video and have their issues highlighted by the coach. Only one of the nine had seen themselves on video before and that was a long time ago. The instructions from the coach seemed to mean a lot more to the subjects when they could actually see themselves on video.

Other comments from the feedback form were:

- *“this process has given me focus for my practice”* – subject 2
- *“gives a mark to work from”* – subject 5
- *“it’s a relative thing and you can measure yourself against the test to gauge your improvement”* – subject 9
- *“highlights your flaws as it’s a great to watch yourself and see things that you would never normally see in your game”* – subject 7
- *“needs to be continuous though – would imagine you would need to do at least three assessments to get a real understanding of your ability”* – subject 2

5.3.1.2 Q2. What was the worst thing about the process?

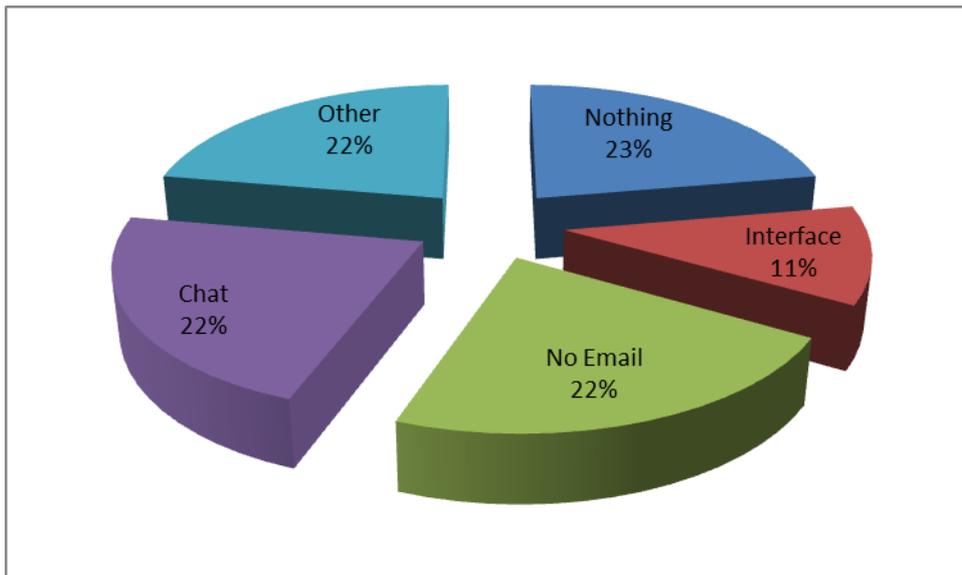


Figure 73 - Worst thing about the process

In question 2 the subjects were asked about the worst thing about the process. Opinion was divided here. Two of the nine could identify nothing bad about the process. Another two would like to have the ability to have email incorporated as part of the process. The reason given for this is the subjects could look at the response to a question in their own time and not have to be tied down to a specific chat time with the coach. Two more found the chat functionality challenging. The reason behind this is that these two subjects were the least computer literate of the nine and found typing difficult. One of the more computer literate of the group thought the interface could be improved by having help and guidance when using the application. There were two comments that were classified under other as they weren't particularly relevant to the process and related to the unsuitability of the time of year this study was taking place as it was the tennis off season and the Christmas holiday period.

5.3.1.3 Q3. Was your tennis knowledge improved?

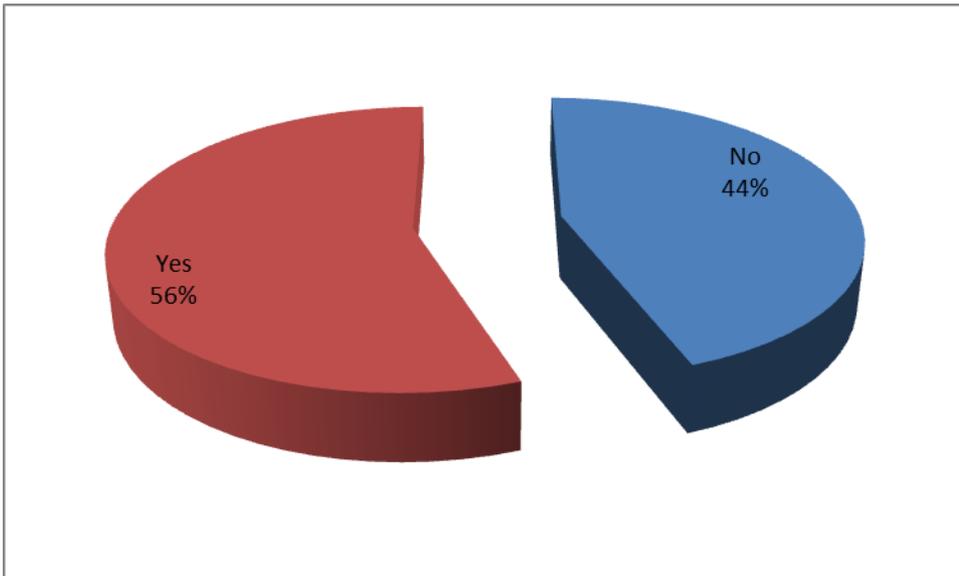


Figure 74 - Was tennis knowledge improved?

In question three the subjects were asked had their tennis knowledge improved. There was a real split in opinion here. Five of the nine subjects thought their knowledge had been improved while the other four didn't. The four that didn't were mostly the better and experienced players and had a good knowledge of the game. The more inexperienced players found that their tennis knowledge had been improved.

5.3.1.4 Q4. Was your tennis game improved?

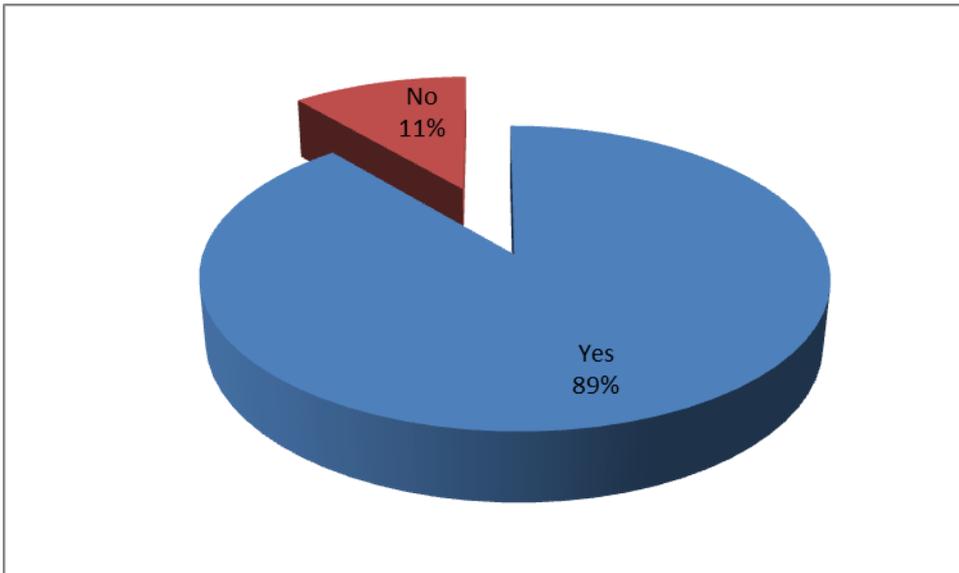


Figure 75 - Was your tennis game improved?

In question four the subjects were asked had their game improved. All of them said yes except for subject three. Even though subject three's overall score had improved by 28% and their focus area actually improved by 57% over the two assessments they did not believe that their game had improved in any way. Interestingly subject three was the only subject who tried to manipulate the scoring system rather than play their normal game. Although all the other subjects thought their games had improved and the scores backed this up one made the comment that:

- *“Obviously, but it is a very short period of time to judge.”* – subject 2

5.3.1.5 Q5. How did you find the learning process?

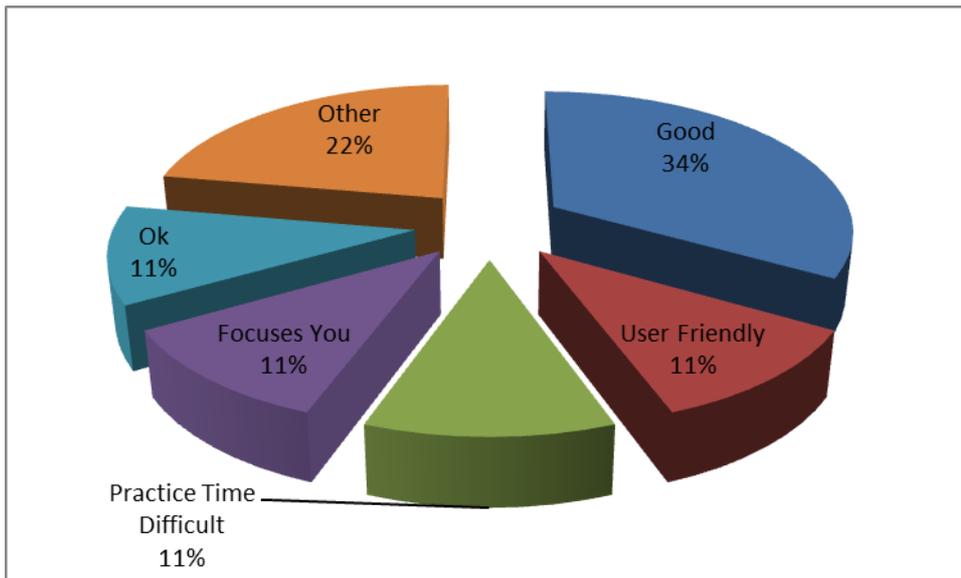


Figure 76 - How did you find the learning process?

In question five the subjects were asked how they found the learning process. All the answers were positive although one subject had difficulty getting their own practice done (they were in the web only group) and another had poor broadband at home but loved the serve and volley instruction videos.

5.3.1.6 Q6. Did the process match your expectations?

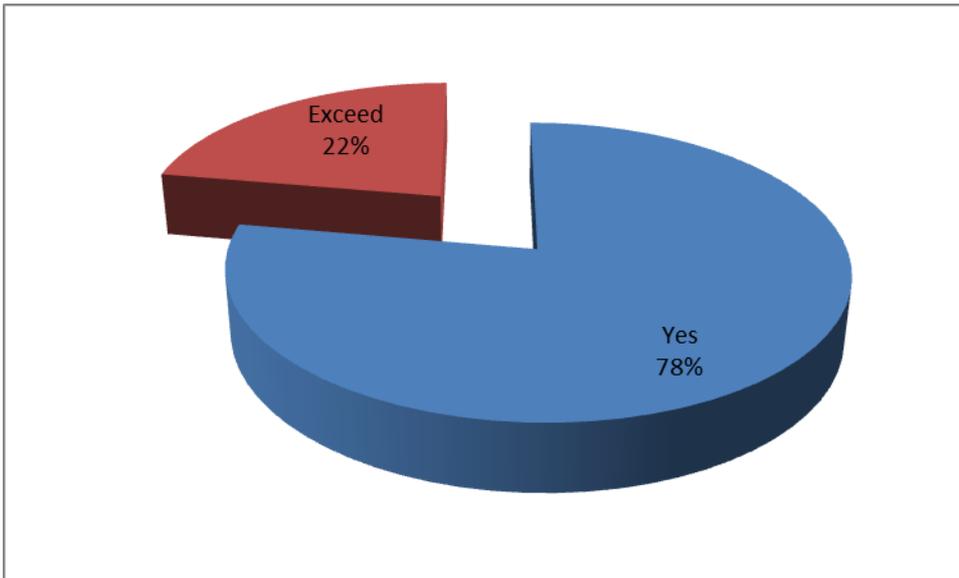


Figure 77 - Did the process match your expectations?

In question six the subjects were asked if the process matched their expectations. All of the subjects were happy that the process had matched or exceeded their expectations.

5.3.1.7 Q7. How could it be improved?

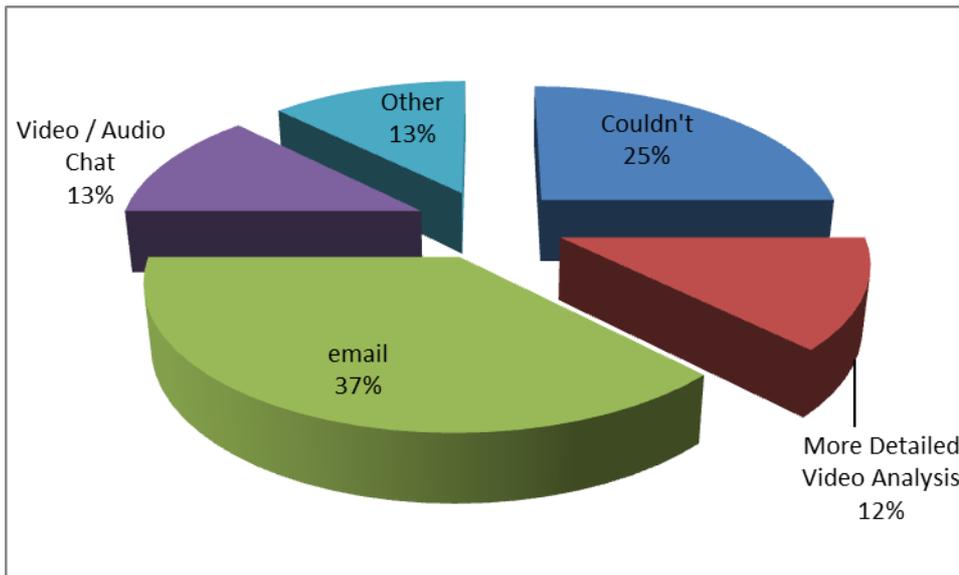


Figure 78 - How could it be improved?

In question 7 the subjects were asked how could the process be improved? Two of the subjects believed that it couldn't be improved. Three subjects actually requested email be part of the process as this would allow them to learn in their own time and think about their responses. They would also like these emails to be recorded like the chats on their profile. One of the subjects who struggled with the typing in the chat area would like to have a video or audio chat console. Another one of the subjects would like more detailed video analysis functionality. Some quotes were:

- “*would like structured asynchronous communication*” – subject 1
- “*being able to use email and have them recorded in the profile area*” – subject 2

5.3.1.8 Q8. Would you continue to use such a system?

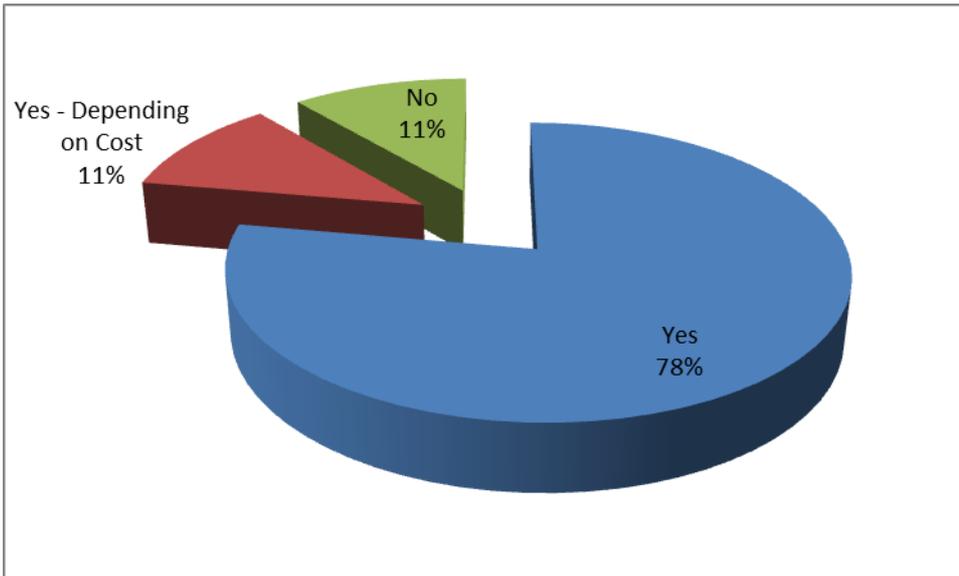


Figure 79 - Would you continue to use such a system?

In question 8 the subjects were asked would they continue to use such a system?

Seven of the nine said outright that they would and one subject said they would depending on the cost.

One of the better players from the web only group said that they wouldn't continue to use the system.

5.3.1.9 Feedback Summary

The feedback was interesting as the players noted:

- Positive
 - Really liked the ITF assessment
 - Gave them a focus for their tennis
 - Was a true test of their skills
 - Them against the court / game
 - Would like to do it on a regular basis
 - Found the feedback in the chats excellent
 - Really found the videos of themselves useful
- Negative
 - Thought that the test was flawed as some of them believed they could manipulate it
 - Would have like video chat and 3D analysis
 - Some of the less computer literate didn't like typing
 - Would need longer to get a true feedback
 - Believed at least 3 assessments were required to really understand your ability
 - Not translatable to match play
 - Asynchronous communication i.e. email – would like that option – most technical guy
 - Time of year and weather

5.4 Results Summary

The goal of the study was to ascertain the effectiveness of web-based learning in sport, with tennis being used as the sport to be analysed. There were five sources of data for this study, four quantitative and one qualitative. The first data was received from questionnaires. These had to be completed prior to starting the process and they indicated that there was a good spread of experience and skills typical of the club players targeted for this study and without exception they all wanted to improve their games. There was a gender imbalance with only one female subject and eight male, all were of a similar age group 40-50. One important issue that was highlighted was that whilst all the subjects indicated that they wanted to improve their game only one of them was actually doing something currently (drills with a friend) and two others were using the web. The other six were either doing nothing or having the occasional lesson. Time and money (83%) were cited as the main reasons why the subjects were not doing more to improve their performance. Interestingly 78% (n = 7) were at a new club even though most of the subjects had been playing tennis for over 6 years and some as long as 30 years. The knowledge of the subjects was poor in relation to tennis equipment and tactics with only 22% knowing if their strings suited their game. 44% of the subjects were already using the web at some level to help their tennis performance. 89% of the subjects said they would use a site as described (78% would pay) and the tailored interactive program was the feature they would most like to use. Interestingly social networking was something 78% of the subjects said they would use but in the ranking of important features it only got 13% of the votes. This would seem to indicate that it's a nice to have rather than a key driver for using such a site.

The next step in the data gathering exercise was the two ITF ITN Assessments. The subjects were broken into two groups. Group 1 was the Hybrid group and had five subjects; they took part in both web and on-court learning. Group 2 was the Web Only group and had four subjects; they took part in web-based learning only. These assessments were carried out approximately four weeks apart. The results were significant. All the subjects' performance improved with an average of a 35% improvement across all groups. The Hybrid group performed the best as expected and their average improvement was 39%. The Web Only group's results were even more significant. The performance across the Web Only group improved by 30%. Taking these results at their face value that would mean that the on-court element of the coaching only added another 9% in performance improvement. One note of caution here is that the deviation in performance of the Hybrid group was large (77% down to 6%) and the sample size was small (5 subjects). The individual results in the Web Only group were much more consistent and showed little deviation. Again care must be taken with these results as the sample size was small again (4 subjects).

One area that showed abnormal results was the focus area. After their initial assessment each subject was given a program to work on with a particular focus area. These areas showed up to three times the

improvement of the overall score. For all subjects their focus area scores from assessment 1 to 2 improved by 124%. This was even higher for the Hybrid Group as their focus area scores increased to 133% improvement in performance from assessment 1. The result for the Web Only group was 111%.

The element of the ITF ITN tennis assessment that proved to be most suited to this process was the serve. Overall the strokes elements of the assessment were relatively consistent in their performance improvement with Ground Stroke Depth (39%), Volley Depth (31%) and Ground Stroke Accuracy (32%). The one area that showed the most improvement over the other strokes was the Serve (74%). The Mobility area scored poorly with only a 5% increase in performance.

The website was well used with all subjects logging in an average of 13 times during the study. On average the subjects visited 66 pages each over the duration of the study. The two areas of the site that took 58% of the traffic were the “My Profile” page and the “Chat” page. These were the two elements that encompassed the main Web 2.0 enablers of user generated content and interactivity. This would seem to indicate that these two main features of Web 2.0 combined with the necessary pervasive bandwidth to access them are the main drives of the learning effectiveness demonstrated in the ITF ITN results in this study.

The final piece of data in this study was the feedback form. Each subject once they had completed their final assessment was asked to fill out the feedback form. The results were very positive with all of the subjects stating that the process had met or exceeded their expectations. The favourite part of the study for the subjects was the ability to watch themselves on video and see what they were doing wrong rather than been told what they were doing wrong like in a normal on-court training session. 56% (n = 5) of them thought their knowledge had been improved and 89% (n = 8) believed their tennis game had been improved. The most positive statistic regarding the effectiveness of the process in improving sports performance was that 89% (n = 8) would continue to use such a system and pay for it.

5.4.1 Results Conclusion

The results were very impressive when you take into account the five different sets of result data. The question that this study aimed to answer was to determine the “The Effectiveness of Web Based Learning in Sport”. The results of this study have shown that the web is an important tool and can be used and measured in its effectiveness in sports learning. In this study we showed in Group 2 (Web Only group), an overall performance increase of 30% across the board. This was a really interesting result as it mirrors (Fletcher 2001) results in the academic world with his rule of “thirds”. From observations during this study and analysing the results data the reasons for this study achieving successful results are as follows:

5.4.1.1 Focused Subjects

The subjects were each given a focus area to work on. When they had some free time they could go and do some work on that area on the website. This is not possible in traditional on-court learning as the subject would have to organise a session with a coach, travel to that session, have usually an hour long lesson and then travel home. This takes a lot of time, effort, organisation plus the monetary element as well.

The subjects knew they were going to be tested again in four weeks so this again focused the mind as very few people like to be seen to fail.

5.4.1.2 Videos of Subjects

Only one of the subjects had previously seen themselves play on video. This was a revelation to most of them and it made it much easier for them to change their games. Previously with on-court instruction they had been told by a coach what to do but when they went away to practice themselves they weren't sure if they were doing it right. With the video analysis they could keep going back to their own video to see what they were doing and could upload videos of them trying what the coach had said and share them with the coach for comment to make sure they were staying on track. The available Web 2.0 capabilities enabled this experience by allowing the easy taking and uploading of video using mobile devices onto their profile in the web application. Combined with this was the ability to interactively web chat about this content with an online coach. The coach was also able to use an android tablet device on court to show the users areas of improvement in their games during on court coaching sessions.

5.4.1.3 Videos of how to do it correctly

After looking at the videos of themselves hitting a shot they were then able to compare that with videos of individuals hitting the shots correctly. This content was regularly changed to match their requirements on the site, especially in the serve area.

5.4.1.4 Ability to get regular feedback and try things out

The ability to try things out on their own, video them and share them with the coach and then get interactive feedback was invaluable and not reproducible in the traditional tennis coaching domain. This again was enabled by Web 2.0 capabilities.

5.4.1.5 Familiarity with the ITF ITN assessment the 2nd time around effect

There is no doubt that an element of the performance increase could be attributed to the familiarity with the test the 2nd time around. Whilst a good explanation was given to the subjects prior to their first ITF ITN Assessment, there was no doubt that the 2nd time they were doing the assessment they were more comfortable and were clearer on what was required. However, this effect would exist anyway even in a traditional tennis evaluation scenario. The only solution to mitigating this effect would be to have this assessment undertaken on a regular basis over a longer period.

5.4.1.6 Anonymity

Some interesting feedback from the Study Coach was that they were asked questions online they had never asked before in a face to face coaching session. It was as if the subjects whilst on-line could say things they wouldn't say in person as they were afraid to seem foolish or asking stupid questions. These findings are backed up by a study from (Headlam-Wells, Gosland et al. 2005), in e-mentoring programs, the distance factor often allows participants to express themselves more freely than in face-to-face communication.. This was also mentioned by subjects 1, 4, 6 and 7 as they felt they had developed a better and more trusting relationship with the coach and felt at ease in the process and were getting a lot out of it.

5.4.1.7 Duration of Study

I believe the duration of the study (approximately 4 weeks) was a contributing factor to the performance increases as well. The Hybrid Group had an overall improvement of 39% with some individuals as high as 77% improvement. Also the focus area improvement in performances were three times the level of overall improvement score with the Hybrid Groups average focus area improvement sitting at 133% and the overall average for the focus are at 124%. This effect has been seen before in academic world. CBI was especially effective when the duration of treatment was limited to four weeks or less (Kulik and Kulik 1991) – the average improvement went from 30% to 50%. This backs up the results attained in this study during the four week period. I believe this level of improvement will level out over time and become more consistent.

5.4.1.8 Hybrid versus Web Only Improvement differential

Whilst it was expected that the effectiveness of the Hybrid learning would be superior to the Web only learning, the differential between them was not. Overall there was only a 9% difference in performance between the Hybrid group and the Web only group. This would indicate that the on-court activities only accounted for a 9% performance increase and the web accounted for 30% of the performance increase. When this was shown to the Study Coach they were not surprised. They stated that unless you are having on-court coaching at least three times a week for one hour plus this being backed up with another three to four hours on-court practice / match play the overall improvement in performance of an individual will be minimal. Most people who receive coaching do so at most once a week and don't do much follow up practice afterwards. They forget what they have been told, or how exactly the coach showed them how to do a particular shot so they may even be practising it incorrectly and actually making things worse as there is no follow up or interaction until the next on-court lesson. The study coach said that most people take on-court training for years with minimal improvement (Stafford 2012).

5.4.1.9 Attrition Rate

In this study we had an attrition rate of zero. This is at odds with most online or blended courses. It has been widely recognized that the attrition of students is a greater problem for online courses than classroom courses. In addition, some research has shown that blended courses should be considered separately from completely online courses when assessing student attrition as blended courses have lower attrition rates. (Wisher and Olson 2003).

The reason for this zero level of attrition may be due to the fact that there was a small sample size and all subjects were known to the study coach. This may not be replicated in larger studies.

5.4.1.10 Validity of Sample Size

It was only possible to have a sample size of nine subjects for this study. However the results attained using this sample size proved statistically significant.

As can be seen from Table 7 the total score as well as all but one of the sub-scores reached statistical significance. In other words, it is highly unlikely that the perceived change in scores is based on random variation of the data and we can assume that learners indeed improved in performance.

Table 9 - Resampling Analysis

Score	Pre- Assessment	Post- Assessment	Mean Change (%)	P
GS Depth	28.78	40.00	57.1%	.0281*
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Serve	31.00	53.89	102.4%	.0055*
Strokes	114.33	165.67	49.0%	.0021*
Mobility	37.44	39.56	5.8%	.1256
Total	151.78	205.22	37.2%	.0016*

The results attained in this study were also in line with previous research carried out in an academic context. The studies of (Fletcher 2001) and (Kulik and Kulik 1991) showed similar results to this study thus validating that the sample size was adequate.

6 Conclusion

6.1 Summary

This study set out to determine the effectiveness of web-based learning in sport. The sport chosen was Tennis because it had an internationally recognised tennis assessment procedure called the ITF ITN Assessment (ITF 2012) that was quantifiable and could be replicated to see progression.

The primary goal of this study as stated in section 1.2 was to ascertain whether results achieved with Computer and Web based learning in academia could be replicated in the sports domain.

A secondary goal was see how effective the two approaches taken in this study were:

- Approach 1: Learning via the web only
- Approach 2: Learning in a hybrid manner – Web and On-Court face to face tuition

Both of these goals were met in full.

The results from this study showed that the results achieved for CBI and Web-based learning in academia were replicated and in some areas surpassed in the sports domain. The overall improvement in performance for all subjects from ITF ITN assessment 1 to 2 was 35%. These were in line with both (Kulik and Kulik 1991) and (Fletcher 2001) who recorded similar levels of improvement in academic environments with similar timelines. So the primary goal of this study was met, results achieved in academia with CBI or WBL can be replicated using WBL in a sports domain. For a more detailed explanation please see section 5.2.3.2 and 5.4.1.

The secondary goal of this study was to see how effective each of the two learning experiences was. The improvement for the Hybrid Group was 39% (see section 5.2.3.3) and the Web Only Group was 30% (see section 5.2.3.4). This was really significant, as expected the Hybrid Group showed a higher level of performance improvement than the Web Only Group, however this difference was only 9%. This intimates that Web only based learning is actually more effective in the coaching of tennis than typical on-court coaching. For a more detailed explanation please see section 5.4.1.8.

6.2 Evaluation

The goals for this study were fully met and validated by the five different result data sets, both qualitative and quantitative. The approach taken during this study was to ensure the highest possible level of validity of findings using structured data collection techniques, simple web based tool for subjects to interact with, independent professional assessment and mentoring, internationally recognised and repeatable quantifiable assessment, suitable evaluation period and fully referenced comparisons with relevant research.

Attributable measurements in performance improvement in the sports domain are difficult as much of the evaluation of sports performance is qualitative. To this end four different methods of data collection were used. The questionnaire (Appendix 1) and the feedback form (Appendix 3) were structured in such a way as to give context both at the beginning of the process and the end of the process to the ITF ITN Assessment results and the website usage statistics.

A web-based learning tool was needed quickly to facilitate this learning research. With the time constraints on this process it came to light during the project planning process that less than a month was available to develop such a tool. A scope of works was created that would deliver a minimum viable beta product for usage by the subjects. The main goals were that it would allow the subjects to view, upload and share content and have the ability to interact with their coach and track their programs, performance and interactions with the coach. The tools used to develop this were Ruby on Rails on the windows platform. HTML5, CSS3 and JavaScript, jQuery and SQLite were used extensively as well. For ease of deployment and availability for the subject's, github was used to deploy to the Heroku platform. This was completed and deployed successfully with only a week slippage from the target project plan date. There was three days of downtime at the beginning of the process which are dealt with in the technical section. No bugs were reported during the subjects' usage of the platform although some recommendations were made for improvements which will be dealt with in the "Future Work" section.

To ensure that the ITF ITN Assessments were done correctly and completed by a qualified certified recognised professional a study professional was recruited. The study coach recruited was called Jamie Stafford (Stafford 2012), for more details please see section 4.2 which gives an overview of Jamie and his credentials. Jamie ensured all the ITF ITN Assessments were carried out correctly. He was also the coach conducting the web based and on-court coaching. Again using a professional independent coach ensures the validity of these findings and results.

It was important to have an internationally recognised and repeatable quantifiable assessment mechanism to ensure the quantifiable results stood up to scrutiny. To that end the ITF ITN Assessment process (ITF

2012) was used. Details of this process can be found on the ITN ITF website (ITF 2012). The ITF is the world controlling body for tennis and its ITN Assessment is the only globally recognised measure of a player's ability. It is repeatable and in fact is meant to be done on a regular basis to track progress. It simulates all areas of the game of tennis from strokes to mobility and even the psychology of match play. The psychology of match play was an interesting observation of the study coach as when subjects were warming up before the assessment began they were hitting better quality strokes than when they were told they were being evaluated.

The findings were significant in their achievement in documenting an overall performance increase of 35% and a Web Only performance increase of 30% and ensured that the primary and secondary goals of this study were met. One area of concern however in relation to the findings and results in this study is the sample size and duration of the study.

The sample size of nine was small and the deviation in results for the Hybrid Group of five was high. It is recommended that a follow up study be undertaken with a larger group, possibly with 48 subjects with 16 in each group with the addition of an extra control group that has no web usage at all.

It is also recommended that the duration of a follow up study be extended to six months. This would allow the 2nd assessment familiarity effect (see section 5.4.1.5) to be negated and it is recommended that there be seven ITF ITN Assessments performed.

6.3 Future Work

At the start of the process the expected results were unknown as no prior art could be found in this area. The prospect of no positive effect at all was entirely possible and would have been a valid finding that would have at least started a knowledge base in this domain to be built upon. However the findings and results were significant and in line with similar academic studies (Kulik and Kulik 1991), (Fletcher 2001) and (Wisher and Olson 2003). To that end it is recommended that a follow up study be undertaken. This study due to its characteristics was time constrained. This time constraint influenced the application development process, the population size and the duration of the evaluation process by the subjects. Each of these key areas could be improved and expanded upon in a larger longer study. Also based on the findings from this study some recommendations for the improvement of the process and the application have been recognised and should be incorporated in any future study.

As discussed in the "Evaluation" section above there were concerns about the sample size being small and the deviation in results of the Hybrid Group being high. It is recommended that a follow up study be undertaken with a larger group, possibly with 48 subjects with 16 in each group with the addition of an extra control group that has no web usage at all.

There were also concerns about the duration of the study and it is recommended that the new study duration be six months and incorporate seven ITF ITN Assessments.

Care will have to be taken in a future, larger study not to lose the ‘intimacy’ which developed in this study which allowed subjects to open up and trust the study coach. The quantity, quality and commitment of the study coaches would have to be closely monitored to ensure a similar environment is attained (Bennett 2002).

The application could also be improved upon with richer and simpler levels of interactivity, improvements in usability, video analysis tools and integration with relevant CRM solutions. The following improvements in the application are based on feedback from the subjects and observations:

Interactivity:

- Simpler (email) - 33% (n = 3) of the subjects wanted the ability to have asynchronous communication i.e. email. The reasoning behind this was that sometimes they didn’t have time to arrange or commit to a certain time for a web chat and would prefer to have the ability to send an email with a question and deal with the response in their own time (anytime, anywhere) and convenience. They would also want these email conversations recorded on their profile like the chats. (Now they actually had a limited ability to do this on the site if they shared a video with the coach they could add a question and wait for him to respond with feedback but they wanted the ability to send text only.)
- Richer (video / audio chat) – 22% (n = 2) of the subjects wanted the ability to video / audio chat as they didn’t like typing and were not very computer literate.

Improvements in Usability

- Addition of help / mouse over guides etc... - One of the subjects correctly highlighted that there were no web guides / wizards to help you use the system correctly.

Integration:

- Create an API to allow integration with other packages such as:
 - Video Analysis
 - Tennis CRM Systems

Finally this WBL tool could be easily adapted for other sports. It would be especially suitable for any sport involving a racquet, bat or club as all that would need to be changed was the CSS and through the admin interface it is easy to change the generic content, everything else is user generated.

Some examples would be the sport of Badminton which has a similar simpler skills evaluation system which can be seen at <http://badminton-network.com/BADMINTON-SKILL-RATING.html> which would enable the WBL tool to be easily adapted for Badminton.

Golf also has a similar system to the ITN system called the 'Golf Skills Assessment Record Sheet', which again make the WBL tool easily adaptable for Golf.

Table Tennis also has a similar system again which can be seen at <http://www.teachpe.com/gcse/Table%20Tennis.pdf> and again the WBL tool could be easily adapted for Table Tennis.

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Appendix 1 – Questionnaire

Q1. What type of player are you – (tick as many boxes as you think are relevant)?

- Beginner Intermediate
- Advanced Social
- Competitive (Club) Competitive (outside tournaments)
- Fitness Just love playing 😊

Q2. How many years have you been playing Tennis?

Q3. How long are you with your current club?

- What is the name of your current club?
- Have you played at other clubs?
 - If so, how many?

Q4. What Level do you play at? I.e. Class 6

(If over 35, also state what level you play at there)

- Do you play league tennis for your club?

Q5. Do you want to improve your game?

- If yes, how do you do this currently?

- Are you happy with the results?
- Would you like to do more?
- If so, why don't you?

- Is cost an issue?

Q6. How did you choose your current racket?

- Looked nice in a shop
- Someone gave it to me
- It was recommended by a friend
- Recommended by coach
- Saw it on the web
- Advice from the web

Q7. Does your current racket suit your game?

- Yes
- No
- Don't Know
- If your answer is No or Don't Know – were you aware it is possible to choose a racket that can suit practically anyone's game – would you be interested in finding out more?
 - Yes
 - No

Q8. Do your strings suit your game?

- Yes
- No
- Don't Know
- If your answer is No or Don't Know – were you aware it is possible to find strings that can suit practically anyone's game – would you be interested in finding out more?
 - Yes
 - No

- What Tension do you use in your racket?
 - Tension
 - Don't know
 - If you don't know – were you aware it is possible to find strings that can suit practically anyone's game – would you be interested in finding out more?
 - Yes
 - No

Q9. Are you happy with your current understanding of Tennis tactics?

- Yes
- No
 - If not, would you be interested in learning more?
 - Yes
 - No

Q10. Have you ever used the web for any of the above activities?

- Yes
- No
- If so, which websites did you go to?

- Indicate how happy you were with the experience
 - Happy
 - Ok
 - Not Happy
 - Very Unhappy
- What were the main issues you faced:
 - Information hard to find
 - Poor Advice
 - Not Professional looking website
 - Service Level
 - Not Available in Ireland
 - Delay's
 - No one place to find all information
 - Targeted to advanced / professional players
 - Other
- What were the best things about these sites?

Q11. Would you use a website that had all this information in one place plus coaching and a social networking element to exchange ideas / issues / improve your game arrange matches etc.?

- Yes
- No
- Maybe

Q12. What would be the most interesting feature of such a website?

(Please give a ranking between 1- 5 with 5 being highest for your level of interest)

- Standard Coaching Material – Strokes
- Standard Coaching Material - Tactics
- Tailored Interactive Programme for all facets of your game
- Advice on Tennis Gear
- Tennis Social Networking Community

Q13. Would you pay for web based coaching and advice?

- Yes
- No
- Maybe
- If so, how much would you pay for generic material from a library about forehands, backhands, serve etc..?
- How much would you pay for tailored coaching based on your game and your needs where you could upload videos of yourself – talk to the coach on-line – ask for advice before matches and feedback afterwards?

Q14. Do you like the idea of a Social Network where you can share experiences, content etc...? with your peers both locally and internationally?

- Yes
- No
- Maybe

Appendix 2 – User guide

User Guide – Players

Log into your Account

Web Address: <http://blooming-lake-8379.herokuapp.com>

Username: xxx@xxx.xxx

Password: xxxxxx

My Details

- Fill out this section first
- Level field means class you play league in i.e. Class 1 – Class 7

My Profile

- This is where you will find the program that the coach will assign to a Player
- You can add, share, edit and delete any Videos either of interesting tennis videos or videos of yourself asking for advice.
- You will receive an email to the email account you specified with any videos and text that have been shared with you. You can then add them to your account
- Here you will also find the ITF ITN assessments that the coach gives you

Chat

- Click on Chat to Schedule Chats with the coach
- Coach will come back either accepting or rejecting chat
- Click on Chat button on bottom bar to start chat with coach at pre-ordained time
- Please try and arrange at least one chat per week with Coach

How Can We Help? Area

- Here you can get Generic Information on such things as “Improving your shots”, “Equipment for you” and “Tennis Tactics”.
- This will be updated on a regular basis
- Please try and use at least once a week.

User Guide - Coach

Log into your Account

Web Address: <http://blooming-lake-8379.herokuapp.com>

Username: xxx@xxx.xxx

Password: xxxxxx

My Details

- Fill out this section first
- Level field means class you play league in i.e. Class 1 – Class 7

My Profile

- This is where you will find the assessments, programs and videos you have given players
- You can add, share, edit and delete any Videos of interesting tennis videos that would be useful for the players. Try and share as many videos as you can with them.
- You will receive an email to your email with any videos and text that have been shared with you. You can then add them to your account

Players

- Click on Players – you will see all the Players that have selected you as coach.
- If you click on these Players you can see their details
- Please click on “Give Assessment” and input in the assessment scores that the players attained

Assign Program

- Click on Assign Program
- Select appropriate Player
- Give them a program to work on for the week based on their initial assessment

Chat

- Click on Chat to see Schedule Chats with Players
- The Coach will get an email requesting a Coaching session that you can accept or reject
- Click on Chat button on bottom bar to start chat with Player at pre-ordained time
- Limit Chats to around 15 minutes

Appendix 3 – Feedback Form

What was the best thing about the process?

What was the worst thing about the process?

Was your tennis knowledge improved?

Was your tennis game improved?

How did you find the learning process?

Did the process match your expectations?

How could it be improved?

Would you continue to use such a system?

Appendix 4 – ITF ITN Assessment Form

International Tennis Number — On Court Assessment

Name: _____ Date of Birth: _____ Sex: M F
 Assessor: _____ Date: _____ Venue: _____

what's your number?



International Tennis Number

GS Depth			Volley Depth			GS Accuracy			Serve		
Stroke	#	Score	Stroke	#	Score	Stroke	#	Score	Stroke	#	Score
Forehand	1		Forehand	1		Forehand DL	1		1st Box Wide	1	
Backhand	2		Backhand	2		Backhand DL	2		1st Box Wide	2	
Forehand	3		Forehand	3		Forehand DL	3		1st Box Wide	3	
Backhand	4		Backhand	4		Backhand DL	4		1st Box Middle	4	
Forehand	5		Forehand	5		Forehand DL	5		1st Box Middle	5	
Backhand	6		Backhand	6		Backhand DL	6		1st Box Middle	6	
Forehand	7		Forehand	7		Forehand CC	7		2nd Box Middle	7	
Backhand	8		Backhand	8		Backhand CC	8		2nd Box Middle	8	
Forehand	9		Sub Total			Forehand CC	9		2nd Box Middle	9	
Backhand	10		Consistency			Backhand CC	10		2nd Box Wide	10	
Sub Total			Volley Depth Total			Forehand CC	11		2nd Box Wide	11	
Consistency						Backhand CC	12		2nd Box Wide	12	
GS Depth Total						Sub Total			Sub Total		
						Consistency			Consistency		
						GS Accuracy Total			Serve Total		

This ITN Assessment was conducted in accordance with the guidelines set forth in the Official ITN Assessment Guide. I hereby agree to its authenticity.

Signed by/belief of the player:

Signed by the Assessor:

Strokes Total	Mobility Score	Total Score

Mobility Table

Time	Score

T	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	
S	1	2	3	4	5	6	7	8	9	10	11	12	12	14	15	16	18	19	21	26	32	39	45	52	61	76	
Score (F)	57-79	80-108	109-140	141-171	172-205	206-230	231-258	259-303	304-344	345-430																	
Score (M)	75-104	105-139	140-175	176-209	210-244	245-268	269-293	294-337	338-362	363-430																	
ITN	ITN 10	ITN 9	ITN 8	ITN 7	ITN 6	ITN 5	ITN 4	ITN 3	ITN 2	ITN 1																	

Number of Assessments	New ITN Rating

Circle players ITN level after completing the Assessment.