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The Southern Institute of Technology Journal of Applied Research (SITJAR) is an online journal that specialises in applied research in the vocational and educational sector. The journal seeks original material in any field of applied research related to vocational education and training and is aimed at practitioners, academics and researchers.

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Showcasing undergraduate degree staff-student research at Southern Institute of Technology

Jo Smith

Welcome to this special edition of SITJAR that presents a small number of the staff-student research projects undertaken at Southern Institute of Technology in 2010/2011. This special edition arose from the observation that there were a number of excellent small scale research projects being undertaken as part of the undergraduate degree curricula with findings that would be of interest to a wider community. The purpose of this edition is to disseminate some of the research findings from eight studies across the disciplines of massage therapy, environmental management, and sport and exercise.

In addition, as part of the self evaluation process, it was a good opportunity to reflect on our collective practice as educators, supervisors, and novice researchers (students), and to explore the purpose and processes involved in undergraduate research. Accordingly, students and supervisors were invited to submit a brief report on their research findings along with a brief reflection on the research / supervision process. Student researchers were asked to comment on:

a. what they learned by conducting the research;
b. what skills they gained or practices they learned that may be relevant to their future, and
c. what support they needed from the supervision process to help their project be successful.

Supervisors were asked to comment on:

a. their educational goals for students undertaking the research study;
b. their approaches to supervision and what aspects of the supervision process they particularly enjoyed, and
c. the supervision processes that they found most effective.

Students enrolled in any one of the 11 vocational undergraduate degrees at the Southern Institute of Technology commonly undertake a research project in their final (third) year of study. Research projects are an extension of the theoretical research papers taught in years one and two of the undergraduate degree curricula and allow students to apply research theory to projects of their own choosing. The project is a systematic investigation incorporating common research processes. These include: 1) identifying a broad area of study, 2) selecting the research topic, 3) deciding the approach, 4) formulating the plan (including ethics applications where appropriate), 5) collecting data/information, 6) analysing and interpreting data and 7) presenting the findings.

The research process and project has several educational functions: application and integration of knowledge with practice; beginning training in research processes and project management; independence and collaborative practices; report writing and oral presentation skills; critical analysis and reflective thinking; problem solving; awareness of the relevant literature and current issues within a discipline; an ability to source and use and critique evidence-based research, and proficiency in the use of information technology. The following comment by Anna Palliser reiterates these learning goals:

My overall educational goal for my students was for them to be able to undertake an independent piece of research and write it up in a professional manner. I also wanted them to be confident in working with members of the public, government agencies, industry etc. as they undertook their research. An important part of the process was learning how to effectively problem-solve. As problems arose that necessitated innovative solutions and changes to their original proposal, students learned experientially how these could be addressed and overcome. Another important learning experience was learning how to embed their research into related prior research via the literature review, using this both to situate and contextualise their own work and to assist in developing their own proposals.

The research projects are not expected to make significant contributions to new knowledge and, due to the short timeframes, the projects are often limited in scope. At the same time, the findings from many of these projects are relevant and thought-provoking, and have practical applications. As a result of the vocational nature
of the undergraduate degrees, projects can be carried out in collaboration with industry and may inform industry practices, and findings can act as a stepping stone for future research. While they may be limited in scope, Erine Van Niekerk still wants her student projects to “produce outcomes that are tangible”, Donna Smith wants her student research projects “to contribute to the emerging massage therapy literature and research culture”, and Ross Ramsay’s educational goals for the research programme were to “encourage the student to devise a project which allowed a profile for research, to undertake the research methodology and research process, and for any outcomes to have relevance to the people of Southland”.

Table 1: What approach do you take to supervision and what aspects of the supervision process do you enjoy?

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<thead>
<tr>
<th>Mentor</th>
<th>Approach to Supervision</th>
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<tr>
<td>Duncan McKenzie</td>
<td>The approach to supervision is to: act as an academic mentor; help facilitate the research process; set explicit expectations and requirements; provide constructive feedback and a critical yet professional analysis; encourage intellectual rigor, and provide an environment of continued personal and professional support. What I enjoy most about the process is the opportunity to be part of the students’ growth process, sharing in their passion about their chosen research topics, and seeing the students succeed and develop into successful graduates we can be proud of.</td>
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<tr>
<td>Erine Van Niekerk</td>
<td>I take a very ‘hands on’ approach to supervision. For example, students are often lacking in confidence when it comes to approaching people outside SIT who may be able to help them in various ways with their research. One aspect of the supervision process that I really enjoy is leading them into networks of connections, suggesting people for them to contact or setting up meetings and sometimes accompanying them to these. I enjoy seeing students becoming more confident in both initiating contact with people and in their own ability to discover ways to overcome problems that arise, often by daring to ask for help and advice from a range of people; I consider this a vital life skill as well as an important research skill. I also enjoy helping students to clearly define their project. It is very satisfying to see a loosely defined project begin to take shape and to see students gain confidence and enthusiasm as what once seemed daunting begins to seem possible and even enjoyable. I meet with my students often and for the first few months of the process I may go to meetings with them and help them to source equipment. I may go out into the field with them so they can talk me through the procedures they are following and we can discuss any glitches or gaps. Once they have collected their data we often extensively discuss the best ways to present this and, as they begin writing draft chapters, I will proof-read them and suggest ways that their writing can become more professional and their organisation can be improved. Often the last couple of weeks before their reports are due are the most time-intensive for me as students begin to feel they are running out of time and need a lot of support, encouragement and assistance with proof-reading.</td>
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<tr>
<td>Hennie Pienaar</td>
<td>As mentor, I enjoy the opportunity to discuss research options and to challenge research methodology. The process has resulted in a high standard of research from very motivated and independent student thinkers. Seeing students complete their research and discuss their research at our Public Poster Day is very rewarding.</td>
</tr>
<tr>
<td>Anna Palliser</td>
<td>I see my role as supporting students to find their own processes and closely guiding them through the research criterion, which outlines clear requirements with regards to ethics, methodology and data collection and analysis. We meet once a week for a discussion and a progress report in the initial stages. The enjoyment I get is watching students and their projects develop. At the end of the year they are proud of what they have achieved and can reflect on journeys of discovery with regards to topics they are passionate about.</td>
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A number of pitfalls can arise within a research project that can affect their feasibility and its ability to be completed. Student reflections highlight some of these pitfalls. Typical issues include students: underestimating or overestimating the level of work required; getting side-tracked into irrelevant activities; becoming lost in the literature; ending up with irrelevant or non-analysable data, or not appreciating the time it takes to complete various stages. The success of a research project depends very much on the hard work of the students and the quality of supervision that students receive. In many instances, the role of the supervisor is to guide the scope of the project and to provide structure and support for each stage of the research journey. The tables report supervisors’ narratives about their approach to supervision (Table 1) and effective supervision processes (Table 2).

Table 2: What supervision processes do you find most effective?

I find that a supervisor needs to be involved in every step of the way. This is not to do the work for the student but to facilitate the process, giving guidance where necessary and stepping back when appropriate. I find it very effective to have regular scheduled meetings with students, to keep a record of all suggestions and recommended changes, and to follow up on these with students. Also effective is a detailed timeline of expected outcomes; not only in terms of the planning and data collection process, but also for writing up the research. I always require students to start writing up the first chapter of the research report as soon as the proposal has been finalised. This is followed with regular deadlines for further chapters. Students are then required to make the necessary changes before they submit the next chapter. This process is very time intensive but very effective. (Erine Van Niekerk)

Our current supervision strategy of using both the class tutor and an academic mentor has provided an excellent balance in assisting the student. Responsibility remains with the student and very little manipulation or editing of work is done by supervisors. (Duncan McKenzie)

Effective supervision processes include: continual support and guidance with key topics; making use of a reflective journal and an activities log, and providing students with opportunities to critically reflect and analyse their experiences. I set protocols for all student-supervisor meetings. All structured meetings should have a set agenda. Easy and regular access to the academic mentor is essential. (Hennie Pienaar)

I think for me that the most effective approach is becoming involved in their projects. I tend to operate more like an involved facilitator than a formal supervisor and for the type of students I have been working with to date, who have been overseas students (who are often very lacking in confidence in doing research in New Zealand), or mid-range to low achievers, this has worked very well. In being willing, for example, to extensively proof-read early drafts of chapters I have seen the academic writing ability of some students blossom to the extent that some have become keen (and able) to consider undertaking a masters degree, which is very satisfying to see. Also by initially engaging with them in trying collaboratively to resolve problems, I have seen them begin to act more independently, contacting people by themselves and feeling pleased with themselves for being able to solve problems on their own. Rather than tie students into a fixed and regular time for meeting with me, I tend to let them arrange an appointment when they need to, while always making sure that I do see them if too much time appears to be passing. Students all have different ways of working; some work better with lots of support and some prefer to be more independent. I tend to (within limits) work with students in the ways that suit them best as individuals, something that is only really possible at present because our students numbers are not too high. If classes were larger I could not offer the same flexibility and (more or less) ‘open door’ policy. (Anna Palliser)

Being accessible to students is important, either by email, phone or face to face. Effective communication is important especially around the research process, and providing them with clear examples of what is required of them. This often alleviates some anxiety around the enormity of the year’s work ahead of them. In addition, being interested in their project and understanding why they chose a particular topic and doing everything you can to enhance their learning. (Donna Smith)
It can be seen that whilst supervisors avoid telling students “what to do”, direction is given on the standards required, topic scope, networks, timeframe of research stages, report writing and, at times, the development of specific skills. The amount of supervision time varies according to the approach taken and the phases of the research process, however supervisors are available to students throughout the research journey. It is clear that staff supervising these projects have shared goals and interest in outcomes for the research, are passionate about the projects, and have a strong commitment to working with their students to realise successful outcomes. The student reflections suggest that student researchers appreciate the strategies used by their supervisors.

We are proud of the research accomplishments of many of our undergraduate students and of the quality supervision they receive. Supervisors have enjoyed collaborating with their student researchers (now graduates) to write these brief reports of their research findings. All reports have been through a peer-review process prior to publishing. I hope you enjoy reading them. As the Special Edition Editor, I thank Sally Bodkin-Allen, Jo Whittle, and Jerry Hoffman for their support and assistance with completing this edition. I also thank the Southern Institute of technology for hosting the Journal and supporting its continued production.
Objective: Establish the knowledge and beliefs of the general public about massage therapy.

Design: Descriptive cross-sectional intercept style survey.

Setting: The survey was conducted outside 5 supermarkets in Invercargill, New Zealand.

Participants: Five hundred members of the general public.

Main Outcome Measures: Exploratory analysis of the closed and open-ended questionnaire.

Results: Relaxation was the leading impression of massage therapy. Massage therapy was reported as good for neck stiffness (423 of 476; 89%), muscle strains (408 of 468; 87%), lower back pain (409 of 472; 87%), and stress (404 of 474; 85%). Only 10% (46 of 451) thought massage therapy was bad for acute inflammation. Many people were unsure about the usefulness of massage therapy for a large number of conditions.

Conclusions: Knowledge of massage therapy contraindications was low. Education still needs to address the safety of massage therapy for certain conditions, as well as raise awareness of the specific conditions that massage therapy may be of benefit.

Key Words: massage therapy, knowledge, modalities, indications, contraindications

BACKGROUND

Massage therapy, incorporates a variety of approaches (Sherman, Dixon, Thompson, & Cherkin, 2006), and is one of the four largest complementary and alternative medicine (CAM) professions (Cherkin et al., 2002). Massage therapy may be used as an adjunct or stand-alone therapy by a number of health care providers such as nurses, physiotherapists, other CAM providers, and massage therapists (Smith, Sullivan, & Baxter, 2010). Globally the use of CAM is widespread and its use has increased substantially over recent years (Barnes, Powell-Griner, McFann, & Nahin, 2004). Historically massage was part of many ancient cultures and was often considered to be medicinal practice, and is now one of the fastest growing sectors of the expanding CAM movement. Within New Zealand, results from the 2006/07 New Zealand Health Survey indicated that one in five adults (18.2%) had visited a CAM practitioner over the 12-month period, and of these, over half had seen a massage therapist (Ministry of Health, 2008).

As more people seek alternative forms of healthcare, at times without a referral from a medical doctor, the onus is on the massage therapist to determine their client’s knowledge and awareness of massage therapy, and gain informed consent for treatment (Massachusetts, 2010). Research to date has explored the conditions treated with CAM (Barnes et al., 2004; Cherkin et al., 2002) as well as the effectiveness and outcomes of massage treatment (Moyer, Rounds, & Hannum, 2004).

The aim of this research was to provide a snapshot of the awareness of massage therapy (modalities, indications and contraindications) in the general public.

METHODS

A survey questionnaire was developed specifically for this study and initially trialled (n = 10) on random members of the general public (aged 21-71 years) to check for understanding and timing. The questionnaire incorporated both closed- and open-ended questions and sought information on participant demographics, utilisation of massage therapy, awareness of massage modalities, and beliefs about conditions that could benefit from massage therapy. After minor word changes, the questionnaire was administered (during July 2010) using a scripted approach in a mall-type intercept strategy where people were approached outside five targeted supermarkets at different times of the day and invited to participate. Persons greater than 16 years with the ability to understand written English participated and the data was recorded in an anonymous manner by the researchers.
The sample size was selected to represent approximately 1% of the Invercargill population of 50,328 (Statistics New Zealand, 2006).

Ethical approval was obtained from the Southern Institute of Technology School of Health, Exercise & Recreation Ethics Committee. The data were entered into a spreadsheet (SPSS 17) for the generation of descriptive statistics, and a word cloud using Wordle for qualitative data analysis.

RESULTS

Of the 1437 people approached, 500 people (318 females, 167 males) volunteered to complete the questionnaire; not all questions were answered by all respondents. The majority (425 of 498; 85%) were New Zealand Europeans and a small number identified as Māori (59 of 498; 12%) and Pacific Islanders (16 of 498; 3%). Age was distributed from seventeen to seventy-five plus; the most common age group was 45-54 years (102 of 489; 21%), and just under two-thirds (310 of 496; 62%) of respondents had used massage therapy before.

When asked “what comes to your mind when thinking of massage?” the words “relaxing” and “relaxation” were most commonly stated (Figure 1). The most common perceptions of who used massage therapy were: athletes (62%; n=496), the general public (61%; n=496), and people who were injured (54%; n=496). Respondents who had previously had a massage were more likely to consider massage therapy an appropriate treatment for everyone (p<0.01). The conditions that respondents thought massage therapy was ‘good for’ or ‘bad for’ are presented in Figure 2. Neck stiffness was the most recognised indication for massage therapy, followed by muscle strain, lower back pain and stress. Massage therapy was reported by over half of respondents to be bad for kidney failure, fever, and burns; however, some respondents disagreed or were unsure. People were also unsure about the usefulness of massage therapy for some conditions (e.g., heart conditions).

Figure 1: Words commonly associated with the term “massage”; larger text represents words used more often.
A wide range in awareness of the different massage therapy modalities was reported. Relaxation massage was the modality with the highest level of awareness followed by acupuncture and beauty therapy.

Little was known of massage therapy modalities such as myofascial release, neuromuscular technique, or muscle energy techniques.

Figure 2: Knowledge of indications / contraindications for massage therapy by the general public.
DISCUSSION

Although a high number of participants had experience of massage therapy, the knowledge of massage therapy modalities was limited. Whilst relaxation was the most recognised modality, the public were also aware of ‘deep tissue’ and ‘therapeutic / remedial massage’, terms commonly seen in massage therapy advertising. The awareness of sports massage as a modality is compatible with the perception of athletes being users of massage therapy. There was little awareness of the specialised techniques/modalities employed by massage therapists, suggesting a need for education in this area.

Musculoskeletal problems featured high on the list of conditions that the general public believed would benefit from massage therapy; a pattern consistent with the massage utilisation literature (Smith, Sullivan, & Baxter, 2009). Over 70% of participants also thought that massage therapy would be beneficial for ‘stress’, ‘anxiety’, and ‘depression’. What is not clear is why people thought massage therapy was beneficial for these conditions; it may be because they know of people with these conditions who use massage therapy or that massage therapy is indicated for these conditions. For all conditions listed, approximately 3-15% of the public thought that massage therapy was bad, even for conditions where massage therapy is generally indicated. Also of note is the lack of knowledge of the suitability of massage therapy for a large number of conditions. Of greater concern was that people’s knowledge of massage therapy contraindications was low. In particular, many considered that massage therapy would be appropriate for acute inflammation; a well publicised contraindication for massage therapy (Accident Compensation Corporation, 2010).

As the public can access therapeutic massage treatments without referral from a general practitioner or other health professional, massage therapists themselves are a primary source of education about the indications and contraindications for massage therapy. Being aware that the client may not have an appropriate understanding on the benefits or otherwise of massage therapy for their health condition(s) can assist the massage therapist to better educate massage clients on the appropriateness of treatment.

This pilot study is limited in that it only sampled the general public of Invercargill and may not be representative of public knowledge in other regions where there may be greater or lesser exposure to massage therapy as a health practice. Although the questions were presented in a scripted manner, there is the possibility that the interviewers may have introduced bias in the way they were presented. Notwithstanding these limitations, the data does provide insight into the public perceptions and knowledge of massage therapy. Future studies could address similar questions in other cities and town in New Zealand.

Findings also suggest that awareness information needs to be specifically targeted towards suitability of massage therapy, and this information needs to be easily accessible to the public. Education needs to address the safety of massage therapy for certain conditions, as well as raise awareness of the specific conditions where massage therapy may be of benefit. A barrier to raising public awareness about massage therapy is the difficulty in defining massage therapy due to its range of modalities and approaches, and infancy in evidential research. Knowledge empowerment about massage therapy will have some challenges but should not be overlooked by massage therapists, sports injury management programme developers, public health officers, and the massage therapy professional bodies.

References

As students and practitioners of massage we are immersed in a culture that can, at times, seem baffling to those who have never experienced any of its various modalities. This research project gave us the opportunity to step outside of our insulated world of massage learning and see what the general public perceived massage to be all about.

The results while not entirely surprising did show us that as people educated in massage we have an onus to share our knowledge with our clients, for the betterment of their health, and understanding of what massage is appropriate for and capable of.

During the process of conceiving and executing this project we developed a deeper understanding of research in general. This skill has been invaluable to our on-going learning and gives us the ability to stay engaged in the contemporaneous research of massage. Support was essential to achieve this project, because as first time researchers it is all too easy to lose focus and direction; especially when results are being obtained that suggest further topics of investigation.
Behavourial indicators of professionalism: massage therapy students’ perceptions

Tracey Senior, BTSM, * Georgette Yanouzas, BTSM,* Nicki Jury, BTSM, * and Donna Smith, BTSM, PGDip (Tert.Tchg)*

**Objective:** The aim of this study was to explore Bachelor of Therapeutic and Sports Massage (BTSM) students’ perceptions of professional behaviours and the values they hold in relation to professionalism in a massage therapy setting.

**Design:** A qualitative approach using data gathered from focus group interviews (n=9) and face-to-face interviews (n=9) was used.

**Setting:** Southern Institute of Technology (SIT), Invercargill, New Zealand.

**Participants:** BTSM students.

**Main Outcome Measures:** Not applicable.

**Results:** Excellence, respect, and communication emerged from the data as key themes of professionalism.

**Conclusions:** Professionalism is of paramount importance within a health care setting; in massage therapy it may be an important contributing factor to client comfort. A number of indicators of professional conduct in a massage therapy context are reported. These indicators are an important step in building and evaluating the concept of professionalism in massage therapy.

**Key Words:** massage therapy, professionalism, professional behaviour

**BACKGROUND**

The concept of professionalism began with the Hippocratic Oath, a profound promise by physicians to serve for the welfare of society (Cruess & Cruess, 1997). Practicing medicine was considered a calling, and altruism, an ancient Hippocratic value, and was assumed to be the motivation to becoming a doctor (Van de Camp, Vernooij-Dassen, Grof, & Bottema, 2004). Today, the components of professionalism in medicine revolve around expertise, ethics and service (Cruess & Cruess, 1997), and include elements of presentation, conduct, communication and teamwork between colleagues (Jha, Bekker, Duffy, & Roberts, 2006). Liaschenko and Peter (2003) suggest that in addition to the historical influences noted above, perceptions of professionalism change over time as the values and systems structures within a society change. Still, it is generally agreed that the specific characteristics of true professions are the possession of a unique body of knowledge, provision of an altruistic service to society, and autonomy in the sense of control over their work and work conditions (Liaschenko & Peter, 2003).

At the core of massage therapy, as in other health professions, is the relationship between the client and therapist (Benjamin & Sohnen-Moe, 2003) and the need to provide a quality service to benefit the client. Previous massage therapy research indicates that professional behaviours may be important to clients and are important in creating client comfort (Smith & Smith, 2006). But what is unknown are the components of professional behaviour in massage therapy? Before professionalism can be measured, professional attitudes and behaviours need to be defined and described. The aim of this research was to explore massage therapy students’ perceptions of behavioural indicators of professionalism.

**METHODS**

Focus group and face-to-face interviews, using a combination of unstructured and semi-structured questions, were conducted with Southern Institute of Technology (SIT) Bachelor of Therapeutic and Sport Massage (BTSM) students. First, unstructured questions provided participants the opportunity to share their own perceptions and terms; second, the research team introduced additional themes as open questions for the participants to consider and comment on. The proposed questions, potential probes, and focus group process was piloted with a group of year one BTSM students. Data collected from the pilot study was valuable and met the criteria of
the focus group requirements. With consent of the pilot study participants, this data was included. Interviews were used with year two and three students as there were insufficient numbers of participants to create separate focus groups. The study was approved by the SIT Human Ethics Committee.

Sample and Recruitment
Purposeful sampling of student participants enrolled in the SIT BTSM programme (year one, two and three) was used. Participants who volunteered provided informed consent, which included permission for the focus group discussions and face-to-face interviews to be audiotaped. The focus group participants were grouped by year of study in an attempt to equalise group dynamics and promote a more uninhibited atmosphere to express their views.

Data collection and analysis
Two focus groups (n=6, n=3), lasting 60 minutes, were conducted in June 2010. Five interviews with year two students and four interviews with year three students were conducted in July 2010. The audiotape data collected from all discussions/interviews were transcribed, read through by all researchers, and coded. Themes that emerged are represented through narrative and specific quotes from the various participants (Creswell, 2003). A consistency check of the key themes was done; the themes emerging from the study were unanimously accepted. Pseudonyms are used.

RESULTS
Three themes within professionalism were uncovered: (1) excellence; (2) respect; and (3) communication. A number of indicators were also reported for each theme (see Table 1).

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<th>Excellence</th>
<th>Respect</th>
<th>Communication</th>
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<tr>
<td>Knowledge</td>
<td>Scope of practice</td>
<td>Appropriate language</td>
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<tr>
<td>Skills</td>
<td>Informed consent</td>
<td>Understanding &amp; empowerment</td>
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<tr>
<td>Standards</td>
<td>Relationships &amp; boundaries</td>
<td>Listening &amp; attentiveness</td>
</tr>
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<td>On-going development</td>
<td>Confidentiality</td>
<td>Collaboration</td>
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<td>Being prepared</td>
<td>Altruism/Client focus</td>
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<td>Time management</td>
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Excellence
The theme of excellence included six subgroup indicators as outlined below. The narratives below illustrate participants’ views regarding excellence.

High levels of knowledge, skills, and high standards were seen as important to allow the massage therapist to design individualised treatments and to achieve the greatest sense of well-being for clients. Elli referred to needing: a big spectrum of knowledge so you can pick up what is wrong with them[clients] but as well can advise them to different directions [regarding] stretching, exercising, nutrition. Knowledge is a core part of our professionalism; it could mean the difference between being successful or very successful.

Bill thought: “you should set high standards for other people to look up to as well”, and with the client in mind Bill also stated the need for: “a broad tool box so you can actually give the client the best possible treatment. But if you don’t have them, refer them.”

On-going development was also important for improving the quality of care. Gina said: “oh yes, I don’t think that there will ever be a day where you stop learning as massage therapists, there is so much to learn.” Ned agreed saying: “well I think if you think excellence is achievable, you are aiming too low. You can always raise the bar. There is always more to learn, especially with the human body.” Ray commented that:

I think professionalism is also that the therapist needs to keep up with and take more training. We should always learn more techniques, further research. Especially if you have clients and they have different problems, make sure you keep adding to your kete [tool kit]. Make sure you have lots of different ways to do
stretches, lots of different strengthening techniques and a vast range of treatment techniques as well, because everybody is different. Different techniques might work differently for different people, especially when it comes to those stretches and strengthening techniques, you need to know as wide a range as possible so that on the professional scale you just need to be looking at ways to improve yourself all the time. It should be on going, just keeping up with what’s going on out there.

Two students also noted that reflection is a professional obligation and useful for development. For example, John thought: “that’s another thing, self-reflection, I don’t think you can ever ask yourself too many questions and reflect too much” and Olive added: “that’s where the diary thing and goals and reflections, at the end of the day, really help even though they are the most annoying things in the world to do.”

Being prepared was also perceived as an indicator of professional conduct. For example, all participants agreed that being prepared starts right from first contact with the client. Sam commented on the: “the phone call, the appointment, talking to someone” and Ned focused on preparation in terms of: “a warm room, and a friendly person. I would expect everything clean, hygiene standards met, in terms of the person, the linen, the room, the environment.” Being prepared also meant adhering to self-care as a therapist, for example, looking after yourself means that you deliver the best service to your clients. Roy commented that:

- it’s important to be job fit if you are a therapist and that can be looked at as similar to a sportsman. You can’t play a good game if you have a bung knee, then you can’t give a good massage if you’re unfit.

Tom agreed, adding: “if you don’t look after yourself, you can’t do your job properly and then you might not be able to do the job at all . . . it’s very, very important stretching, icing, and getting regular massage for yourself.” Lastly, in regards to excellence, managing your time well for yourself and for your clients was seen to be an important indicator of being professional. Gina stated: “keeping time as a professional and keep within that time limit, and we need to charge and be comfortable to charge an appropriate price”, whereas Tom thought of time as a clear boundary: “it’s not moving the boundaries, saying these are the hours I keep and my hours of work. You need to have clear boundaries and not move them.”

**Respect**

Demonstrating respect for clients was a key aspect of professional conduct. For example, Ned said: “a therapist that conducts themselves in a professional manner so they are very respectful of the client and respectful of the client’s wants and needs.” Gina had a similar view and commented: “you can affect people emotionally by doing massage; you have to have respect for their feelings and space.” Clients were viewed as unique and valued individuals. Five specific areas were discussed in relation to showing respect: scope of practice, informed consent, relationships and boundaries, confidentiality, and altruism/client focus.

Practising within a clear scope of practice was seen as ethical and respectful. This was most clearly reported by Ruth who said: “try not to be a physiotherapist, be a massage therapist, but not having a narrow mind.” Informed consent was an ethical responsibility but also a mark of respect, and as illustrated by Elli’s comment, it was also an act of empowerment: “explaining and lots of talking and lots of explanation why and empowering the client so that he knows.”

Keeping good therapeutic relationships and boundaries was another way of showing respect. For example, Ann stated that she would: “expect a therapist who is going to respect boundaries for themselves like parameters that they are going to work to and stick to them so you know they are honouring their wants and needs as well.”

Similarly, Ned commented that:

- you can’t have a relationship which crosses any of those lines [boundaries] because you are compromising the treatment progression and you are allowing the client to have an emotional attachment to you or vice versa and it will compromise all the other areas of your work.

Maintaining confidentiality by: “having your files locked away” and respecting a client’s privacy were important. Roy commented that: “yeah, definitely I expect it, anything that happens between me and my therapist remains within those four walls.”

Lastly, participants thought
that an attitude of altruism and behaviours that were client focused indicated respect and were a mark of a professional. Ruth said: “I know people do jobs for money and all that but I want to help people ... that’s what it’s all about, being able to help people.” Examples of a client focus included listening and “a therapist that doesn’t speak to me unless I speak to them.”

Communication

Integral to the concept of behaving professionally was the theme of communication. Participants thought the therapist should ensure that appropriate language was used to fit the individual needs of the clients. Ned stated that: communication is important, so that both client and practitioner are speaking the same language, that there’s a commonality of communication whether the therapist speaks plainer or they pitch to their audience. Some clients are quite well educated about their bodies and know things, so communication needs to be appropriate.

Communication was also important for presenting a knowledgeable image to the client. A therapeutic relationship is built on trusting the therapist’s expertise and knowledge, as commented by Olive: “communication is definitely a big thing in professionalism. The way you communicate is very important. If you sort of um and ahh and stutter about, it makes you seem like you don’t know what you’re talking about.”

Words are used as a tool to create understanding between the therapist and the client, not to create status or barriers. Ray shared this view by saying: “I would expect that a therapist would speak in terms so the client can understand, so that the client is always informed.”

Communication also included listening and attentiveness. For example, Ray thought: “really listening to your client and engaging with the client and making sure they are giving their client their full attention” was important. Elli had a similar view about the importance of attentiveness towards clients commenting that: “taking clients seriously and not overriding them and listening is a huge point for professionalism because I think it divides if they [therapist] are just putting some such things on me and not listening to my story.” Participants thought that the massage therapist needed to clearly communicate what a treatment entails to avoid misunderstanding and to create the trust that is the key to a professional relationship. Client empowerment through gaining informed consent and understanding the treatment process was also linked to the ability of the massage therapist to communicate clearly with the client.

Good written communication skills when documenting treatment sessions was important because as Ann pointed out: “taking notes, especially....if you’re not available next time, your notes have to be legible so that the next therapist will be able to read them and say [to the client] ‘this is exactly what we did last time’.” Also, quality communication between therapists was another facet of professional behaviour reported by participants. This was seen to be particularly important in a clinical setting or group practice. For example, Ned stated that: “if you’re working in a multi-disciplinary group, the client does need to know that as a therapist, they need to be aware that your notes are not just your notes. They are a record for everybody in the team.” In the context of working as a sports therapist, Sam shared the view of the need for communication and teamwork saying that: “communication is a big thing, especially if you are working in sport. Teamwork, you need to be able to talk to physios, managers, trainers, it’s a big thing.” Elli also saw: “teamwork [collaboration] as enabling you to see things from different sides and angles which created more knowledge on your side as well.”

Communication between massage therapists was a way for them to exchange ideas that ultimately led to providing clients with the highest quality care. Therefore, adequate communication to allow collaboration to occur was also an indicator of professional conduct.

DISCUSSION

Excellence was highly valued in massage professionalism among the student massage therapist. Excellence was reflected in many ways. A professional image was especially important. Image ranged from clothing and personal hygiene to a confident and friendly manner with clients. The appearance of the massage setting was important to create comfort and develop the trust of a client. Obtaining knowledge and expertise through education and on-going development was also of the utmost importance. These aspects of professionalism were perceived by massage students as important for their own benefit and more importantly for the benefit of their clients,
to help therapists provide the best quality and appropriate treatment. These views are in agreement with VanZandt (1990) who suggests that it is an individual who possesses professionalism, should always be trying to live up to the existing standards of the professional and critically looking to see in what ways improvements may be made to pursue a higher ideal. Professionalism should impel actions that encourage attainment of higher ideals and high standards from colleagues as well.

Respect towards clients was highly valued; an attitude that is consistent with contemporary massage therapy practice (Benjamin & Sohnen-Moe, 2003). Massage students accepted the responsibility of protecting client confidentiality and privacy. Respect for privacy was viewed as integral to professionalism by massage students who showed an awareness of their clients’ vulnerability in a massage treatment. Keeping ethical boundaries were a way to protect the client and allow massage therapists to put the welfare of the client first. Respect was an aspect of being an ethical professional as well as valuing the trust relationship between the client and therapist. Receiving informed consent from the client was one way a massage professional showed respect for the clients’ autonomy and by providing information empowered the client to play a role in their own health. Massage students had high regard for empowering their clients who sometimes express that they want to be listened to and understand what their choices are.

Massage students showed a high level of awareness for the need for quality verbal, non-verbal, and written communication, as well as physical communication through the skill of touch. All four aspects of communication were integral to a professional massage treatment. The most important factor was that communication was the base of the professional/client relationship. Massage students were aware that the use of language is an aspect of professional behaviour (LaSala & Nelson, 2005). It was through communication that the therapist’s knowledge, confidence and caring was expressed to the client. Student massage therapists are in agreement with the expectations of medical patients who highly rate communication skills, which include listening and making terminology understandable, as the most important aspects of professionalism to patients (Wiggins, Coker & Hicks, 2009). As group practices become more popular, clear communication is vital between therapists to ensure clients receive quality treatment and so that a group of therapists can function effectively towards this objective.

It is important to recognise that the qualitative research findings presented above relate to students enrolled at one massage therapy school. However, results from this study indicate that while the concept of professionalism is complex, a number of indicators of professional conduct in a massage therapy context have been identified. The indicators reported clearly align with the interpersonal, public and intrapersonal professionalism themes in medicine reported by Van de Camp and colleagues (2004). These findings also give insight into students views on a number of professional issues related to client care. Future research could explore the views of massage educators and practising massage therapists with the view to developing a measurement tool to evaluate professional conduct in massage therapy.

References
Student researcher reflections

Firstly we learnt the process of conducting research. We also learnt to think critically about research, to analyse other research and gained confidence in oral presentations. Working within a group was good for all of us as it gave each of us the opportunity to shine in our own specialist areas as well as having extra support when anxiety levels were high. It was vital for the success of our project that we managed our time and work load efficiently and this has helped to hone our organisational skills for when we may be thinking of starting our own businesses.

Having never undertaken any type of research previously, it was crucial to have a supervisor who was knowledgeable about the research process, was passionate about the need for research to further the massage industry and was approachable and available for consultation. We needed weekly meetings to keep us heading in the right direction and to keep us to our time line.

Abstract: While innovative renewable energy technologies (RETs) are now abundant, there are many barriers to their implementation, with one key barrier being the reluctance of people and communities to adopt new technologies. This paper discusses two research projects based in Southland, South Island, New Zealand, that show how both quantitative, technology-based research and qualitative social science research can help to engage communities more positively with renewable technologies, while also providing information that can help government agencies further the use of RETs. The first project was based on Rakiura (Stewart Island) in Southland and uses a model solar panel to trial an optimal position for panel location and to investigate panel performance from this position. The results were positive, showing that careful positioning of panels could result in improved performance. The second project investigated the opinions of Southland dairy farmers about using methane digesters (MDs) to generate energy from farm waste. The results indicated farmers had a positive attitude to MDs but lacked sufficient information about their feasibility and lacked connections to agencies that could supply this.

Key Words: renewable energy; renewable energy technologies; solar energy; methane digester technologies; renewable energy transition; social legitimation

BACKGROUND

Renewable energy technologies (RETs) currently have the potential to meet current energy needs (Painuly, 2001) and it is now considered that the important issue is not the technical potential of RETs but “how this potential can be realised and substantially contribute to a transformation of the energy sector” (Jacobsson & Bergek, 2004, p. 208). Public attitudes to specific technologies and to RETs in general are currently deemed crucial in determining energy futures (Owens & Driffill, 2008) and it is considered that: “in the area of energy consumption, there is a need to take account of the physical, social, cultural and institutional contexts that shape and constrain people’s choices” (Owens & Driffill, 2008, p. 4412). In investigating the energy transition to RETs, Verbong and Geels (2007) point out that, while public authorities may try to affect the direction taken by this transition, ultimately they cannot control it. Therefore, in addition to relevant policies, the perceptions, strategies and actions of firms, utilities, special interest groups and consumers should also be explored.

New technologies often lack social legitimation, resulting in people being wary of investing emotionally or financially (Carroll, 1997) and blocking market formation (Bergek, 2002). Networks can increase social legitimation, shaping perceptions about what is possible or desirable. Jacobson and Bergek (2004) discuss the importance of networks as channels of knowledge and point out that being well-integrated in a network means that individuals have access to information and also to other interested or involved individuals. Broad sections of society need to see RETs as legitimate in order for incentives to be developed and for firms to enter the market (Jacobsson & Bergek, 2004).

Social acceptance of RETs is thus a crucial, complex and inadequately understood facet of the renewable energy transition and further research is needed to improve understanding of how to increase this acceptance (Owens & Driffill, 2008). The two research projects discussed below contribute toward this improved understanding in the context of Southland, New Zealand. Both were final year projects of SIT environmental management undergraduates for which ethical approval was granted by SIT Ethics Committee.
Project 1: A study of solar energy performance on Stewart Island: Is Stewart Island ready for solar generation?

Stewart Island, located off the southern tip of New Zealand, is off the National Grid and reliant on diesel for electricity generation. The island’s electricity authority has been investigating RETs for alternative generation, undertaking trials of both wind and solar energy. Locals have become disillusioned with the solar trial due to low outputs of electricity. These consists of two amorphous photovoltaic panels (two kilowatts each) located on two large buildings in the main township of Oban. The aim of this study was to investigate if relocating and re-orientating the solar array currently located on the Department of Conservation (DOC) building in Oban would significantly improve performance.

Method

A small amorphous solar panel (four Watt) – the ‘model panel’ – was located at a higher altitude than the existing DOC panel and calculations were done to orientate it to an angle that maximised solar irradiation on the panel. The model panel was connected to a Campbell Scientific CR200 datalogger, using Campbell PC200 software to communicate with a laptop, which recorded output data (Campbell Scientific, 2005). An analysis was undertaken to calculate potential performance losses due to shading on the model panel using the method adopted by Appelbaum and Bany (1980). A shading analysis was also carried out for the DOC panel and its angle of orientation calculated. Data was recorded from both the model and the DOC panels over a six week period (August/September 2011).

Results

Due to differences in both size and data measuring devices between the model panel and the DOC panel, the simplest way to present results clearly was to show how many hours per day each panel was receiving sunlight. Table 1 (below) compares the daily hours of irradiation received by the DOC panel and the model panel on a selection of the data-gathering dates. The results clearly illustrate the increased irradiation received by the model panel. Figure 1 (below) illustrates the same data in graph form, again showing the increased performance of the model panel.

Table 1: A comparison of the two solar panels showing hours of irradiation per day.

<table>
<thead>
<tr>
<th>Days</th>
<th>Dates</th>
<th>SI DoC Panel Hrs/day</th>
<th>Modelling Panel Hrs/day</th>
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<tbody>
<tr>
<td>1</td>
<td>21/08/2011</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>25/08/2011</td>
<td>4.5</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>31/08/2011</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>15</td>
<td>5/09/2011</td>
<td>4.5</td>
<td>8</td>
</tr>
<tr>
<td>20</td>
<td>10/09/2011</td>
<td>5</td>
<td>7.5</td>
</tr>
<tr>
<td>25</td>
<td>15/09/2011</td>
<td>5.5</td>
<td>7.5</td>
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<tr>
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<td>20/09/2011</td>
<td>7.5</td>
<td>8</td>
</tr>
<tr>
<td>35</td>
<td>25/09/2011</td>
<td>7</td>
<td>9.5</td>
</tr>
<tr>
<td>38</td>
<td>28/09/2011</td>
<td>5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Figure 1: Graph showing hours of solar irradiation per day falling on the two panels.

Conclusion

The results illustrate that a relocation and re-orientation of the solar trial panels on the island could improve their performance. The research has provided valuable technical information for Stewart Island’s electricity company and, if disseminated to Stewart Island locals, may re-motivate them into continuing their investigations into renewable energy for the island.
**Project 2: Social feasibility study of a Methane Digester System using dairy farm waste products in Southland**

Methane Digester (MD) technology can utilise dairy waste materials to produce methane via a process of anaerobic digestion. This methane can then be used in a gas microturbine to produce electricity (Nelson & Lamb, 2002). While the agricultural industry is one of the biggest producers of waste material globally and in New Zealand, MD technology remains underutilised in New Zealand. The aim of this research was to discover the perceptions of Southland farmers about this technology and possible reasons for its underutilisation.

**Method**

Eight Southland farmers were contacted via the snowball technique (Robson, 2002) and agreed to partake in semi-structured interviews. The interviews were recorded and analysed by a method suggested by Kitchin and Tate (2000) as suitable for new researchers. Prior to the interviews, farmers were given an information sheet about MD technologies compiled by the researcher. This was to ensure that farmers who had little or no prior knowledge of MD technologies and available subsidies could consider this information before being asked to discuss their opinions about it. Interviewees were then asked about their knowledge and perceptions about MDs prior to reading the information sheet; and whether, now they had read the information sheets, they would consider investing in them. They were asked for their opinions regarding incentives and subsidies for MDs, and about their knowledge of the RET projects being run by Venture Southland (a local government organisation delivering community development and enterprise services to the region).

**Results**

Most of the farmers considered that MDs were a good idea but had little prior knowledge of them and had not investigated the possibilities of installing an MD system. Over half the farmers considered a mixture of environmental and financial reasons as the most important reasons for taking up the technology and, interestingly, three quarters did not think that there should be government grants available to assist farmers in installing MD technology. They did believe that there should be a good price paid for any electricity they produced and supplied to the National Grid, however. None of the farmers had been aware of any central or local government incentives to foster this technology.

Farmers preferred advisory organisations as sources of information for decision making although they also ranked internet articles, farm magazines and the opinions of people who had implemented MDs as important sources. Farmers also showed interest in having one-to-one consultations about MDs to assess their options, with 25% saying if options were feasible they would be willing to implement an MD system. While most farmers had heard of Venture Southland, few had any contact with them or knew about their RET projects.

**Conclusions**

According to the findings of this research, lack of social acceptance of MDs did not appear to be a key barrier to their uptake. Key barriers instead seem to be inadequate access to appropriate information, inadequate incentives and insufficient government promotion. Farmers did not appear to be part of a network with Venture Southland, a key player in business and community development in Southland and were very open to the idea of one-to-one consultations with an organisation such as Venture Southland to explore MDs further.

**CONCLUSION**

Solar and methane digester technologies have not been widely embraced by the Southland region, which is only just beginning to consider them as potentially viable energy options. These two projects have played a useful role at this stage in providing information to involved local authorities that may help to further the implementation of RETs in the region. Should local authorities act on some of the results and liaise with locals about these, it would be interesting to carry out further research into how this changes local perceptions and attitudes. By interacting with and providing information to local communities, both projects have also acted as a bridge between locals and relevant authorities, thus potentially contributing to the building of networks that can shift perceptions of what is possible and desirable in terms of RETs.
Generating social acceptance of renewable energy technologies

Student researcher reflections

Response from Peter Prekopa (project: A Social Feasibility Study of a Methane Digester System Using Dairy Farm Waste Products in Southland)

Through my project I learned that the interactions between stakeholders, and the current socio-economic and technical systems are important reasons for the slow uptake of MD technologies among dairy farmers in Southland. I also obtained some practical research skills that assisted me in obtaining information from the interviewees. Furthermore, the project gave me the opportunity to practice some conflict resolution abilities that helped me to establish trust between myself and participants. I believe that these skills could play a vital part in my future employment in the field of environmental management, helping meet the growing need for the active involvement of the broader population in sustainable lifestyle and practices. My supervisor Anna Palliser guided me along in the project by assisting me with the questionnaire construction and connecting me to field experts who provided me with information and findings from previous research in this field.


Prior to this research process I had to gain a great deal of theoretical knowledge of solar installations, angles and geometry. Having a background as an electrician prior to entering this degree I had no concern with practical thinking, however my theoretical knowledge was thoroughly tested. The ability to work to a high professional level with South Island locals and the district council was an important skill gained. Other skills I gained involved the use of the computer software system (PC2000W) and its setup process/communication needed in order to ensure the accurate modelling of the solar panel system. This project would not have been so successful without the continuous support of my research supervisor, who helped me with making contacts and sourcing equipment, as well as providing guidance for how to structure and write a professional report.

References
Anthropogenic Debris on Oreti Beach, Southland, 2011

Erin C. Searle, BEM,* and W. Ross H. Ramsay, PhD*

Abstract: This research relates to the presence of anthropogenic litter found on Oreti Beach, Southland, New Zealand during 2011. Anthropogenic debris in the marine environment is a growing problem worldwide and this contribution documents the presence of such debris on the most southern beach in the South Island. Debris was collected from 15 beach sample sites, each one kilometre long, classified according to composition and inferred origins, and then related to various spatial variables to explain debris distribution along the beach. Plastic debris was overwhelmingly the main material found.

BACKGROUND

Oreti Beach is Invercargill’s most accessible beach (Fig. 1) and is a popular destination for Invercargill residents and visitors. The beach also differs from other beaches in Southland because of its accessibility by vehicle.

Figure 1: Locality map of Oreti Beach running west of Invercargill as arrowed.

It is therefore in the interest of the community that Oreti Beach is free from unsightly and environmentally harmful litter, but for this goal to be achieved, it is necessary to determine the extent of the problem, its geographical spread on the beach, and the nature and composition of the debris, and to examine where the problem lies and, where possible, its multiple sources. It is to be expected that, because of its durability and floatation properties, plastic will be a major component of the beach-cast marine debris present in all localities. It is for this reason that plastic maintains a significant focus throughout this research. Plastics are becoming an increasing cause for concern in the marine environment because of their characteristics as a synthetic material. One component of beach debris of terrestrial-based origin on Oreti is likely to have been swept to the beach from the Invercargill dump. Plastic persists in landfill sites and, if not properly buried, may later surface to become ‘debris’. Barnes, Galgani, Thompson and Barlaz (2009) comments that the ‘durability of plastic ensures that wherever it is, it does not “go-away’; that is, by placing plastics in landfill we may simply be storing a problem for the future’.

Key features that have a bearing on the transport of beach debris onto and along Oreti Beach are: exposure of the beach to the Southern Ocean and the Antarctic Circumpolar Current; influence by the Tasman Sea and the Sub-Tropical Front (STF) (see Figure 2); and ready public access to certain areas of the beach.

Figure 2: Local marine currents operating around the South Island.
**Research project aims:**
1. to develop spatial profiles along the length of Oreti Beach;
2. to record the composition and amount of beach debris in relation to these spatial profiles, and
3. to attempt to draw some conclusions as to the dispersal methods and origins of this beach debris.

**METHODS**

**Quadrate Allocation**

With the aid of ‘Trip and Waypoint Manager’ Global Positioning System (GPS) software, Oreti Beach was separated into 31 sections, each one kilometre long. Waypoints were set every one kilometre by the use of this computer software, then loaded onto the ‘GARMIN GPSMAP 60CSx’ (GPS model). The use of spatial data was a very important part of this study, and GPS waypoints allowed the research to be carried out accurately over a number of visits to the study area.

After dividing the beach into sections, 15 representative samples along the beach quadrates were chosen as areas in which beach debris collection would take place. Beginning at the eastern end of the study area, a pair of quadrates was allocated every alternate two kilometre section. The location of these quadrates, numbered from 1 (in the east) to 15 (in the west), is shown in Figure 3.

![Figure 3: Location of quadrates along Oreti Beach. Quadrates 1 was located on the south-east extent of the beach and Quadrate 15 near Riverton in the north-west of the beach. The divisions given are each one kilometre in length.](image-url)

**Profiles**

The whole study area was assessed for any spatial variables that could influence the potentially differing amounts of anthropogenic debris along the length of the beach. Profiles were compiled for each quadrate in an attempt to ‘group’ all important variables. By grouping the variables, the potential outcomes for debris origin and distribution (and to some extent composition) could be generally predicted and compared with results.

<table>
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<tr>
<th>Wind Exposure</th>
<th>High</th>
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<th>Low</th>
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<tr>
<td>Quadrates</td>
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<td>1</td>
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<td>5</td>
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These variables alone do not give an accurate prediction as to the potential state of anthropogenic debris in the study area. To achieve better accuracy, two other variables need to be considered: the effects of longshore drift, and the effects of community cleanup efforts.

These effects can be estimated and added to the quadrate profiles in order to predict the probable dispersal of anthropogenic debris. As a result of the dominating south westerly winds hitting the study area, longshore drift was estimated to move debris slowly to the east of where it was deposited. Community efforts were estimated to affect the abundance of debris around one kilometre in either direction of Main Entrance to the beach, around...
100m either direction of North Entrance’ and scarcely at all near Riverton Entrance.

**Data Collection**

Data collection methods involved walking down the wrack line (the line of dried seaweed and other debris and detritus left by the action of the tides) of each quadrate and collecting all transportable debris. All those that were not transportable were either recorded in detail or photographed. Data collection took place an average of two kilometres every visit to Oreti Beach, with three to five people collecting material in each area.

The width of the wrack line was extremely variable throughout the study area and some quadrates took considerably longer to assess than others. Also, in some quadrates, the wrack line had to be estimated, as it had been degraded to an unrecognizable state, usually from vehicle use (see Figure 4).

![Figure 4: Wrack line degradation around Main Entrance, Oreti Beach. The existing wrack line is shown in red on either side of the entrance. The red striped zone indicates that part of the beach and wrackline which has been degraded by vehicles. The green represents the estimated area of the wrack line.](image)

**Data Analysis**

Debris was sorted according to categories and sub-categories, depending on the material composition, the specific object, and the potential origin of the item. Debris composition at each quadrate was compared with the spatial profile for that quadrate. Significant figures were investigated further in order to gain an understanding of the overall setting and what variables played the major role.

The different variables associated with the profiles were compiled into graphs and tables for brevity and greater understanding of how litter composition changed throughout the study area (a method adapted from Hayward, 1999).

**RESULTS**

The material compositions of beach debris in the study area were divided into six categories: rubber, fabric, paper, glass, metal, and plastic. Figure 5 shows that plastic was by far the largest portion of debris collected, accounting for 80% of the total number of items. Well below plastics, comprising 7% of the total material composition, is the second most abundant category, metal, closely followed by glass and paper (5%), fabric (2%) and rubber (1%).

![Figure 5: Total percentage material compositions found on Oreti Beach, 2011.](image)

Figure 6 shows that the highest abundance of debris was found near the Invercargill end of Oreti Beach (quadrates 1-6),

![Figure 6: Material Compositions located in Quadrates 1-15, Oreti Beach, 2011.](image)
and the lowest quantities found at the Riverton end (quadrates 13-15). The highest level of debris was found in quadrant 4 (247 items) followed by quadrates 2 (222 items), 3 (204 items) and 6 (191 items); these four quadrates when combined account for almost half of the total number of items collected throughout the whole study area.

Figure 6 (above) shows the following patterns of debris composition and distribution:

- Rubber comprised only 1% of the debris collected (15 items, made up of six rubber gloves, five bands from burley dispensers and a mixture of unidentified items and a car tire). The majority of rubber (nine items) was found in Quadrates 2 and 4, with the majority being dispersed on the Invercargill end of Oreti.

- The second highest proportion of debris was in the metal category, which contributed 7% of all material collected. Seventy percent of all metal debris comprised aluminium cans, of which 81% once contained alcohol. Bottle tops (mainly beer) contributed 11% of the overall metal debris, with the remainder including such items as springs from inside the seats of abandoned cars, wire reels, toys, lead sinkers and unidentifiable pieces. The highest abundance of metal was located in Quadrate 4, while all other 14 quadrates had reasonably consistent abundance of metal debris ranging from one to nine items per quadrant.

- Glass contributed to just over 5% of the total percentage of debris collected throughout the study area. Half of this was derived from alcohol bottles and a further 6% from non-alcoholic bottles. Glass pieces were the next most abundant contributing to nearly 40% of the total glass debris. Thirty-five percent of the total amount of glass was collected within Quadrate 4, while all other 14 quadrates had reasonably consistent abundance of glass debris ranging from one to nine items per quadrant.

- Paper debris accounted for a further 5% of the total debris in the study area, with various wrappers and labels making up the greatest pro portion (54%), followed by receipts (16%), cigarette filters (9%), and cigarette packets (8%). The remaining 11% of paper debris comprised irregular items such as teabags and cardboard packaging. The majority of the paper debris was collected from Quadrates 3 (five items or 25%) and 4 (30 items or 30%).

Plastic was by far the largest portion of debris collected, accounting for almost 80% of the total number of items collected, and with the majority found in Quadrate 2 (193 items or 87%). Additional plastic spikes were collected in Quadrates 6 (170 items or 89%) and 12 (160 items or 92%) while the lowest amount of plastic debris occurred near the Riverton Entrance (Quadrates 13 to 15). The average percentage of plastics in all quadrates was 81% of debris collected.

The plastic debris collected was further sorted into its specific components, as shown in Figure 7. Rope comprised the largest share at 37%. Sixteen percent was made up of ‘other’ plastic debris that included bullet cartridges, burley bait dispensers and straws, as well as such irregular items as a decoy duck (used in duck shooting), a New Zealand driver’s license, and a cast mould of a large bunny rabbit.

Table 2 lists the items from each category into sub-categories based on their inferred potential origin (land, fishing, anonymous). The number of items as well as the percentage of each category is grouped into each sub-category, and then totalled at the bottom of Table 2.

Table 2: Potential origin of beach-debris, Oreti Beach, 2011.

<table>
<thead>
<tr>
<th>Land</th>
<th>Fishing</th>
<th>Anonymous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Items</td>
<td>%</td>
</tr>
<tr>
<td>Rubber</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>Fabric</td>
<td>29</td>
<td>100</td>
</tr>
<tr>
<td>Metal</td>
<td>139</td>
<td>99</td>
</tr>
<tr>
<td>Glass</td>
<td>107</td>
<td>100</td>
</tr>
<tr>
<td>Paper</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>Plastic</td>
<td>308</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>690</td>
<td>35</td>
</tr>
</tbody>
</table>

The vast majority of items of fishing and anonymous origins are made of plastic (99.2%), while less than half the amount of land-based debris consists of plastic (45%).
CONCLUSION

The origin, composition and distribution of anthropogenic beach cast debris on Oreti Beach depends on the physical environment (currents, winds and waves (longshore drift)) and human activity and access.

The main cause for alarm at Oreti Beach is the high abundance of plastic items washing ashore or being deposited on land and making their way to the shore. Plastics are a major contributor to the debris found in the study area, bringing with them many negative impacts on the environment. Unlike other material types, plastics do not bio-degrade; they persist in the environment and can travel for large distances on ocean currents or winds, but inevitably may become buried on beaches or join the food chain.

The results produced in this study give a good indication that the health of Oreti Beach could be in danger as the abundance of debris (especially plastic) appears relatively high. The first initiative to take is to enforce the ‘no littering’ policy for all visitors to the beach. The next step is to undertake monitoring programmes on Oreti Beach in order to realize how severe the problem is or may become. Monitoring the abundance of debris is important to establish rates of accumulation and the effectiveness of any remediation measures (Thompson et al., 2009). In addition to recording debris, there is a need to collect data on sources. For plastic debris this should include discharges from rivers and sewers together with littering behaviour (Thompson et al., 2009). The Invercargill community could easily be involved with the monitoring of Oreti Beach and from this, a sense of pride would be instilled to keep the coastlines clean.

Acknowledgements:
We thank fellow students for giving up their time in helping to collect and sort debris from the Oreti Beach. Support was also received from Environment Southland and Invercargill City Council.

References


Student researcher reflections

There were many opportunities to pick up new skills over the course of the Oreti beach research. Designing the research project provided the foundations to work off, having a solid outline of what I wanted to achieve helped keep the project on task. Good time management played a large role in allowing me to collect reliable data. I needed to plan data collection visits to fit with the daily tide, and the location from nearest access point to the area of beach that was to be sampled. I also needed volunteers to be available to leave at different hours of day; the collection usually took half a day of volunteer time.

Organising data and keeping track of occurring trends was a skill that I became familiar with through the progression of the research. The most valuable assets I gained that I believe will hold the most relevance in the future were time management, organisation and prioritisation skills.

The support I gained from the supervision process was a very important advantage to the success of this research project. My supervisor, along with other tutors at SIT, proved very useful when expressing ideas and helped greatly in keeping the project moving forward.
Water quality survey of aquatic ecosystems at Te Rere Penguin Reserve, Southland, determining potential risks to resident penguins

Christian Hardy, BEM,* and Erine Van Niekerk, MOB, MTRP*

**Objective:** Give a detailed description of seven key physical and chemical water quality indicators in the main aquatic environments of a Southland penguin reserve over a number of months.

**Design:** Water quality survey.

**Setting:** The survey was conducted at Te Rere Penguin Reserve, Southland, New Zealand, in freshwater and near-shore marine environments.

**Participants:** N/A.

**Main Outcome Measures:** Exploratory analysis of the water quality data gained from field and laboratory testing.

**Results:** Five out of the seven indicators surveyed were outside recommended environmental standards and therefore the aquatic environments at Te Rere Penguin Reserve should be considered at risk of becoming degraded or to represent a potential risk to resident penguins. These risks include eutrophication due to extreme levels of nitrogen and phosphorous, and extreme pH values leading to potentially toxic situations.

**Conclusions:** Recommendations to help mitigate this potential degradation involve more sustainable land management practices within the freshwater stream’s catchment, such as riparian planting and limiting the use of fertilisers, as well as creating a Marine Protected Area around the coastline. Further study recommendations include increasing the number of indicators to include biological indicators such as avian flu and **E. coli**, as well as pollutants such as Persistent Organic Pollutants (POPs) and heavy metals, and extending the testing period to cover daily, seasonal and yearly cycles and climatic variables.

**Key Words:** water quality, te rere, yellow-eyed penguin, little blue penguin, physical and chemical indicators, freshwater, near-shore marine

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**BACKGROUND**

The composition and chemical characteristics of water strongly influence its suitability for life, in particular aquatic life and human use. However, water quality is more than merely the composition of water, and can also be defined as its suitability for its desired use, including use as a habitat for aquatic life. For example, a river may be regarded as of low water quality if its composition limits its use, such as for stock watering or for swimming (Harding, Mosley, Pearson, & Sorrell, 2004).

The Te Rere Penguin Reserve is located approximately 65 kilometres east of Invercargill, on the Catlins coastline in Southland, New Zealand, and is an ideal location for Yellow-eyed Penguins (**Megadyptes antipodes**) and, more recently, Little Blue Penguins (**Eudyptula minor**) to access a rich marine feeding area (Sutherland, 2004). The aim of this research was to aid in the management of Te Rere Penguin Reserve by undertaking a water quality survey to determine the health of the freshwater and near-shore marine aquatic environments and the potential risks it posed for the penguin species that nest there. The results then helped determine whether future management steps need to be taken in order to restore these aquatic environments to recommended safe levels.

**METHODS**

This research project used the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines, published by the New Zealand Ministry for the Environment in 2000, as a basis to determine which water quality indicators should be measured at Te Rere. Seven physical and chemical indicators of water quality were chosen for this research project: total nitrogen, total phosphorous, dissolved oxygen, electrical conductivity, temperature, pH and visual clarity. Testing occurred at Te Rere once a week over a number of months. Three main sites were chosen based on access by the resident penguins;
one freshwater stream (Te Rere Stream) and two near-shore coves (Eastern and Western Coves). In order to obtain a spread of data values throughout the day, water quality measurements were undertaken around three times a day at each site, time and weather permitting, at morning, noon and once again in the evening. Field testing was undertaken using specifically designed water testing equipment including a visual clarity tube, an electrical conductivity/pH probe and a YSI Professional Plus handheld multiparameter meter. Total nitrogen and phosphorous were tested at a later date in a laboratory.

Data values recorded at Te Rere for each of the seven chosen indicators were then compared with their corresponding ‘environmental trigger values’, also published in the ANZECC Guidelines (2000). Each indicator has its own unique set of trigger values, which are maximum or minimum limits that mark the point at which a water body, such as a stream, might be considered unhealthy, thus ‘triggering’ a potential water quality concern should the recorded values for that particular indicator exceed its maximum or minimum limit. Comparing values recorded at Te Rere with their corresponding environmental trigger values thus determines whether a particular aquatic site can be considered unhealthy, should the recorded values exceed their maximum or minimum limit.

The data values recorded at Te Rere were then compared with a new, separate set of limits: physiology parameters recommended by the International Antarctic Centre, Christchurch, which are values considered optimum for penguin health, in order to determine whether the resident penguin species were potentially at risk (see Table 1).

Ethical approval was obtained from the Southern Institute of Technology Ethics Committee, and cultural approval was obtained from Waihōpai Te Rūnanga o Ngāi Tahu representative Michael Skerrett. The data was entered into SPSS Statistics software for the generation of descriptive statistics (Wagner III, 2011).

RESULTS
The water quality testing data for all three aquatic sites at Te Rere Penguin reserve can be seen in Tables 2, 3 and 4. Dissolved oxygen levels generally appeared lower than recommended environmental trigger values, particularly in Western Cove and Te Rere Stream where the recorded results were lower than the trigger values during every testing session. The reduced level of dissolved oxygen is of concern since, if the dissolved oxygen levels continue to fall, the aquatic environments may turn hypoxic or even anoxic, which will impact on the aquatic organisms that live there by depriving them of the oxygen they require to survive (Harding et al., 2004).

Table 1: Water quality indicators and their associated trigger values.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Marine Trigger Value</th>
<th>Freshwater Trigger Value</th>
<th>Penguin Physiology Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (mg/L)</td>
<td>&lt; 0.12</td>
<td>&lt; 0.614</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Total Phosphorous (mg/L)</td>
<td>&lt; 0.025</td>
<td>&lt; 0.033</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Dissolved Oxygen (%)</td>
<td>90 – 110</td>
<td>98 – 105</td>
<td>&gt; 80 ●</td>
</tr>
<tr>
<td>Electrical Conductivity (µS/cm)</td>
<td>N/A</td>
<td>125 – 2200</td>
<td>0 - 2000</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>&lt; 25 *</td>
<td>&lt; 23 **</td>
<td>4 – 13 ●●</td>
</tr>
<tr>
<td>pH</td>
<td>8.0 – 8.4</td>
<td>7.2 – 7.8</td>
<td>7.0 – 8.2</td>
</tr>
<tr>
<td>Visual Clarity (cm)</td>
<td>&gt; 80</td>
<td>&gt; 80</td>
<td>N/A</td>
</tr>
</tbody>
</table>

All marine and freshwater trigger values are taken from the ANZECC guidelines (Ministry for the Environment, 2011) except:
* Southland Regional Coastal Plan (2008).

All penguin physiology values based on data obtained from personal correspondence with the International Antarctic Centre, Christchurch (2010), except:
● Southland Regional Coastal Plan (2008).
### Table 2: Results recorded for Te Rere's Eastern Cove.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of Day</th>
<th>Site</th>
<th>Weather</th>
<th>DO (%)</th>
<th>EC (µS/cm)</th>
<th>Temp (Celsius)</th>
<th>pH</th>
<th>VC (cm)</th>
<th>TN (mg/L)</th>
<th>TP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.06.11</td>
<td>Morning</td>
<td>East</td>
<td>Drizzle</td>
<td>86.0</td>
<td>N/A</td>
<td>10.9</td>
<td>7.0</td>
<td>55.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.06.11</td>
<td>Morning</td>
<td>East</td>
<td>Overcast</td>
<td>76.7</td>
<td>N/A</td>
<td>10.3</td>
<td>8.7</td>
<td>77.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.06.11</td>
<td>Afternoon</td>
<td>East</td>
<td>Overcast</td>
<td>72.3</td>
<td>N/A</td>
<td>10.4</td>
<td>8.5</td>
<td>86.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.07.11</td>
<td>Afternoon</td>
<td>East</td>
<td>Fine</td>
<td>77.0</td>
<td>N/A</td>
<td>10.1</td>
<td>8.4</td>
<td>74.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.07.11</td>
<td>Evening</td>
<td>East</td>
<td>Fine</td>
<td>76.0</td>
<td>N/A</td>
<td>10.1</td>
<td>8.3</td>
<td>76.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.07.11</td>
<td>Afternoon</td>
<td>East</td>
<td>Light cloud</td>
<td>91.2</td>
<td>N/A</td>
<td>9.6</td>
<td>8.8</td>
<td>50.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.07.11</td>
<td>Evening</td>
<td>East</td>
<td>Overcast</td>
<td>91.3</td>
<td>N/A</td>
<td>9.5</td>
<td>8.7</td>
<td>50.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.08.11</td>
<td>Afternoon</td>
<td>East</td>
<td>Drizzle</td>
<td>N/A</td>
<td>10.0</td>
<td>8.5</td>
<td>60.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.08.11</td>
<td>Evening</td>
<td>East</td>
<td>Drizzle</td>
<td>N/A</td>
<td>9.9</td>
<td>8.5</td>
<td>57.0</td>
<td>0.07</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Morning</td>
<td>East</td>
<td>Fine</td>
<td>80.4</td>
<td>N/A</td>
<td>10.2</td>
<td>8.5</td>
<td>68.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Afternoon</td>
<td>East</td>
<td>Fine</td>
<td>79.9</td>
<td>N/A</td>
<td>10.3</td>
<td>8.5</td>
<td>69.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Evening</td>
<td>East</td>
<td>Fine</td>
<td>79.7</td>
<td>N/A</td>
<td>10.4</td>
<td>8.5</td>
<td>74.0</td>
<td>0.08</td>
<td>0.037</td>
</tr>
<tr>
<td>04.09.11</td>
<td>Afternoon</td>
<td>East</td>
<td>Overcast</td>
<td>86.9</td>
<td>N/A</td>
<td>9.9</td>
<td>8.5</td>
<td>56.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04.09.11</td>
<td>Evening</td>
<td>East</td>
<td>Overcast</td>
<td>86.2</td>
<td>N/A</td>
<td>9.7</td>
<td>8.4</td>
<td>54.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3: Results recorded for Te Rere's Western Cove.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of Day</th>
<th>Site</th>
<th>Weather</th>
<th>DO (%)</th>
<th>EC (µS/cm)</th>
<th>Temp (Celsius)</th>
<th>pH</th>
<th>VC (cm)</th>
<th>TN (mg/L)</th>
<th>TP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.06.11</td>
<td>Morning</td>
<td>West</td>
<td>Overcast</td>
<td>74.0</td>
<td>N/A</td>
<td>10.2</td>
<td>8.5</td>
<td>72.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.06.11</td>
<td>Afternoon</td>
<td>West</td>
<td>Overcast</td>
<td>76.7</td>
<td>N/A</td>
<td>10.3</td>
<td>8.4</td>
<td>72.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.07.11</td>
<td>Afternoon</td>
<td>West</td>
<td>Fine</td>
<td>75.7</td>
<td>N/A</td>
<td>9.4</td>
<td>8.4</td>
<td>81.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.07.11</td>
<td>Evening</td>
<td>West</td>
<td>Fine</td>
<td>75.5</td>
<td>N/A</td>
<td>9.4</td>
<td>8.3</td>
<td>77.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.07.11</td>
<td>Afternoon</td>
<td>West</td>
<td>Overcast</td>
<td>84.9</td>
<td>N/A</td>
<td>8.9</td>
<td>8.2</td>
<td>49.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.07.11</td>
<td>Evening</td>
<td>West</td>
<td>Overcast</td>
<td>84.2</td>
<td>N/A</td>
<td>8.9</td>
<td>8.2</td>
<td>53.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.08.11</td>
<td>Afternoon</td>
<td>West</td>
<td>Drizzle</td>
<td>N/A</td>
<td>9.7</td>
<td>8.7</td>
<td>58.3</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>21.08.11</td>
<td>Evening</td>
<td>West</td>
<td>Overcast</td>
<td>N/A</td>
<td>9.5</td>
<td>8.6</td>
<td>63.0</td>
<td>0.35</td>
<td>0.300</td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Morning</td>
<td>West</td>
<td>Fine</td>
<td>77.2</td>
<td>N/A</td>
<td>10.1</td>
<td>8.3</td>
<td>63.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Afternoon</td>
<td>West</td>
<td>Fine</td>
<td>77.6</td>
<td>N/A</td>
<td>9.9</td>
<td>8.4</td>
<td>73.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Evening</td>
<td>West</td>
<td>Fine</td>
<td>76.6</td>
<td>N/A</td>
<td>9.9</td>
<td>8.4</td>
<td>76.0</td>
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<td>0.026</td>
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<tr>
<td>04.09.11</td>
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<td>West</td>
<td>Overcast</td>
<td>83.5</td>
<td>N/A</td>
<td>9.4</td>
<td>8.4</td>
<td>59.0</td>
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<td>04.09.11</td>
<td>Afternoon</td>
<td>West</td>
<td>Overcast</td>
<td>88.3</td>
<td>N/A</td>
<td>9.4</td>
<td>8.5</td>
<td>62.3</td>
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<td></td>
</tr>
</tbody>
</table>

### Table 4: Results recorded for Te Rere stream.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of Day</th>
<th>Site</th>
<th>Weather</th>
<th>DO (%)</th>
<th>EC (µS/cm)</th>
<th>Temp (Celsius)</th>
<th>pH</th>
<th>VC (cm)</th>
<th>TN (mg/L)</th>
<th>TP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.06.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Drizzle</td>
<td>90.4</td>
<td>450</td>
<td>7.1</td>
<td>7.0</td>
<td>51.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.06.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Drizzle</td>
<td>84.3</td>
<td>310</td>
<td>7.5</td>
<td>9.1</td>
<td>20.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.06.11</td>
<td>Evening</td>
<td>Stream</td>
<td>Rain</td>
<td>82.7</td>
<td>285</td>
<td>7.4</td>
<td>9.0</td>
<td>21.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.07.11</td>
<td>Morning</td>
<td>Stream</td>
<td>Fine</td>
<td>80.5</td>
<td>305</td>
<td>5.8</td>
<td>8.6</td>
<td>50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.07.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Fine</td>
<td>78.3</td>
<td>315</td>
<td>5.1</td>
<td>8.3</td>
<td>51.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.07.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Overcast</td>
<td>88.9</td>
<td>325</td>
<td>8.1</td>
<td>8.1</td>
<td>45.6</td>
<td></td>
<td></td>
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<tr>
<td>17.07.11</td>
<td>Evening</td>
<td>Stream</td>
<td>Overcast</td>
<td>88.4</td>
<td>290</td>
<td>8.0</td>
<td>8.0</td>
<td>43.0</td>
<td></td>
<td></td>
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<tr>
<td>21.08.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Drizzle</td>
<td>297</td>
<td>11.0</td>
<td>7.0</td>
<td>48.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.08.11</td>
<td>Evening</td>
<td>Stream</td>
<td>Overcast</td>
<td>307</td>
<td>13.0</td>
<td>7.0</td>
<td>49.0</td>
<td>1.00</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Morning</td>
<td>Stream</td>
<td>Fine</td>
<td>76.5</td>
<td>305</td>
<td>8.0</td>
<td>8.0</td>
<td>35.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Fine</td>
<td>78.8</td>
<td>335</td>
<td>8.2</td>
<td>8.2</td>
<td>45.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.08.11</td>
<td>Evening</td>
<td>Stream</td>
<td>Fine</td>
<td>78.1</td>
<td>335</td>
<td>8.1</td>
<td>8.1</td>
<td>44.0</td>
<td>0.86</td>
<td>0.045</td>
</tr>
<tr>
<td>04.09.11</td>
<td>Morning</td>
<td>Stream</td>
<td>Drizzle</td>
<td>84.9</td>
<td>307</td>
<td>8.1</td>
<td>8.2</td>
<td>43.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04.09.11</td>
<td>Afternoon</td>
<td>Stream</td>
<td>Overcast</td>
<td>84.5</td>
<td>340</td>
<td>8.3</td>
<td>8.4</td>
<td>42.3</td>
<td></td>
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</tr>
</tbody>
</table>
In addition, the pH levels often fell beyond either the maximum or minimum trigger value limits. In particular, the results from the Eastern Cove were outside the environmental trigger value standard during 79% of the testing sessions and Te Rere Stream was consistently outside the trigger value limits. These extreme pH levels may cause the aquatic environments to become too acidic or alkaline. This in turn may impact on the water chemistry, potentially allowing for the dissolving of harmful substances such as heavy metals which ultimately make the aquatic environment toxic. Extreme pH levels may also directly affect aquatic organisms, changing the water beyond their tolerance levels (Mesner & Geiger, 2010).

Visual clarity was often lower than recommended environmental trigger values, particularly in Te Rere stream which was below the minimum trigger value during all testing sessions. However, this is likely due to the high levels of tannin spotted in the stream during field testing, which may have potentially skewed the results. A lack of visual clarity is of concern, however, as it may reduce the amount of light available to the plants and animals living in the water, reducing the ability of plants to photosynthesise and making it difficult for fish and other animals to see their prey (Environment Waikato, 2011).

Total nitrogen and total phosphorous were also generally higher than recommended maximum environmental trigger values. If levels of nitrogen and phosphorous remain excessive, they may stimulate excessive plant growth which can act as a pollutant in the aquatic environments when over-abundant (Harding et al., 2004). Extreme levels of nitrogen and phosphorous may also speed up the growth of algae in surface waters to an unhealthy level, a process known commonly as ‘eutrophication’ (Environmental Protection Agency, 2011).

In terms of the optimum penguin physiology parameters recommended by the International Antarctic Centre, Christchurch, the results usually trended with those for environmental trigger values. If a particular indicator exceeded its trigger value, it was usually also evident that that indicator exceeded its corresponding penguin physiology parameter. This can be seen with the temperature indicator, for example, where data values for all three sites did not exceed the maximum trigger values for temperature, and where all three sites also fell within the recommended temperature range for penguin physiology. Penguin physiology results also tended to be more positive, although this is likely to be due to the penguin physiology ranges being broader than the ranges for environmental trigger values.

**DISCUSSION**

The research indicates degraded water quality at Te Rere Penguin Reserve. Of the seven water quality indicators tested, only two - temperature and electrical conductivity - were at levels that did not pose a risk to the health of the aquatic environment. This means that the results indicate an overall potential risk to penguin health at Te Rere. There are a number of simple recommendations which can easily be implemented to bring all water quality indicators to within their recommended environmental trigger value ranges and so reduce the potential risk of degrading the aquatic environments or harming the penguins.

The first recommendation is to ensure that Te Rere Stream is completely fenced off so as to avoid access to the stream by any livestock such as sheep and cattle from surrounding farms. When livestock have free access to waterways it may cause stream banks to erode, releasing sediment into the water. Livestock may also pollute the water directly with their effluent (Te Ara, 2011). Fencing of streams is in line with Environment Southland’s ‘Living Streams’ Programme (2005), a long term strategy to improve the health of Southland’s waterways for the benefit of landowners, the wider community and the environment. Other advice by the ‘Living Streams’ Programme includes constructing culverts or stock crossings over streams and establishing wetlands on properties (Environment Southland, 2005).

Another recommendation from the research is to increase riparian planting along the edge of Te Rere Stream in order to provide a buffer against run-off of nitrogen and phosphorous from farmland, and from run-off of pollutants from other sources, such as heavy metals from industrial use. Riparian planting will also help to stabilise soil against erosion, which will increase the visual clarity of the water bodies by reducing sediment load. Riparian planting can also provide shade to the waterway, which helps to keep temperature low (Ministry for the Environment, 2001).

Simply reducing or limiting the use of fertilisers within the stream’s catchment is
another useful method of reducing the run-off of unwanted pollutants, such as excessive nitrogen and phosphorous, into waterways. This can be coupled with more sustainable land management practices to help reduce the need for fertilisers to help keep the levels of pollutants in the aquatic environments within recommended values.

The implementation of a simple and specifically tailored water quality monitoring regime by the managers and operators of Te Rere Penguin Reserve will mean that water quality can be recorded and analysed on a more regular basis at the reserve, and over a much longer period of time. This increased monitoring will help to make sure the water is kept within environmentally recommended standards at all times, and will allow a quicker response should an indicator be found to be outside safe levels.

Ultimately, if the goal is to ensure the continued protection of the penguin species at Te Rere in the marine environment, it might be necessary to create a Marine Protected Area around the coastline, covering landing sites and, if possible, feeding areas.

The researchers recommend further study be undertaken at Te Rere, including: increasing the number of indicators to include biological indicators such as avian flu and E.coli, and pollutants such as POPs and heavy metals, and extending the testing period to cover daily, seasonal and yearly cycles and climatic variables.

References
The Effect of Healing Touch on Selected Psychological and Physiological Variables

Delanie McAleer, BRM, BSR,* and Hennie Pienaar, M.Sc.*

Objective: To investigate if Healing Touch will have a positive psychological and physiological effect.

Design: An experimental, single group repeated measures study.

Setting: Data collection was conducted in a simulated clinical environment that was similar to a usual Healing Touch session.

Participants: Eight students (equal gender groups) were recruited from the Southern Institute of Technology’s Bachelor of Sport and Recreation degree.

Main Outcome Measures: Analysis of pre and post state and trait anxiety levels, heart rate, and blood pressure.

Results: State anxiety ratings decreased to a statistically significant level from pre to post Healing Touch in all three sessions. Average trait anxiety ratings decreased in sessions one and two. No statistically significant changes in heart rate or blood pressure were found. Comments from participants about the sessions consisted of descriptive words such as “relaxing”, “good”, “enjoyable”, or “feel better”. One participant reported that an undisclosed physical pain was significantly reduced during the sessions.

Conclusions: The results from this study suggest that Healing Touch may contribute to positive changes in psychological measures of anxiety, specifically state anxiety, and produces a relaxing effect for participants.

Key Words: healing touch, psychological, physiological, anxiety, heart rate, blood pressure

BACKGROUND

The concept of healing is usually understood as a multidimensional process which moves towards an increasing level of wellness (Hover-Kramer, 2002, p. 9). This multidimensional process suggests that healing has a relationship to a much wider view of human reality where illness or disease may be a sign that something may be out of balance:

Inherent in the concept of healing is a wider interpretation of our human reality: illness is not only a physical problem but an indication that there may be imbalance in other aspects of one’s life as well. True well-being is much more than mere homeostasis in the organs. It is a harmonious evolution within physical, emotional, mental, and spiritual aspects of our being (Hover-Kramer, 2002, p. 9).

The use of complementary therapies to aid physical, mental, and spiritual health and wellness is slowly being mainstreamed into modern day healthcare (Maville, Bowen, & Benham, 2008, p. 103). Healing Touch is one of these therapies. The goal of Healing Touch is to restore harmony and balance in the energy system which places the client in a position to self-heal. The Healing Touch practitioner uses their hands to clear, energise and balance the human energy field (Healing Touch New Zealand, 2008, p. 5). The human energy field is the entire interactive dynamic of human subtle energies, which consists of the chakras, the biofield, and the meridians. Healing Touch techniques focus primarily on the biofield and chakras (Healing Touch New Zealand, 2008).

Several studies into the effectiveness of Healing Touch have demonstrated evidence to support its use as an effective health enhancement therapy. These studies have demonstrated that Healing Touch can raise secretory immunoglobulin A (sIgA) concentrations, lower stress perceptions, promote a relaxation response, and relieve pain (MacIntyre et al., 2008; Maville, Bowen, & Benham, 2008; Wardell, & Weymouth, 2004; Wilkinson et al., 2002).

The primary aim of this research was to investigate if Healing Touch would have a positive psychological and physiological effect; participants receiving Healing Touch treatments would demonstrate improved outcomes in anxiety reduction and cardiovascular variables (heart rate, systolic and diastolic blood pressure).
A secondary aim was to contribute to the growing body of research into the effectiveness of Healing Touch.

**METHODS**

An experimental single group repeated measures study was used to measure the effects of Healing Touch on state and trait anxiety, heart rate, and blood pressure. Eight participants (4 male, 4 female) attended three Healing Touch sessions over three weeks. Participants were aged 19 to 39 years, with an average age of 28 years. Two of the participants reported having had some previous experience with complementary modalities. No participants reported having had previous experience of Healing Touch. All participants signed a consent form and did not receive any financial remuneration for their participation.

Data collection was conducted before and after each Healing Touch session (state and trait anxiety and blood pressure). Heart rate was recorded in real-time by a Suunto comfort belt and transferred to the Suunto software program. Blood pressure was taken with a sphygmomanometer placed on the participant’s right arm and a dual head stethoscope. Statistical analysis was conducted by the statistical software programme SPSS (version 17.0). Qualitative data included feedback from participants during or after the session, which was written down and then read back to the participant to ensure accuracy.

Anxiety levels were measured by the State-Trait Anxiety Inventory for Adults self-report questionnaire (STAI). Anxiety is characterised by subjective feelings of apprehension, tension, worry, and nervousness (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983, p. 4). State anxiety is considered transitory and is how one is feeling at a given moment in time, whereas trait anxiety is considered to be relatively stable individual differences in anxiety-proneness (Spielberger et al., 1983, p. 5).

Healing Touch sessions consisted of a pendulum and hand scan assessment of the chakras, the Full Body Connection (FBC) and Hands in Motion (HIM). The FBC (Figure 1) is a sequence of hand placements from the feet to the head (Hover-Kramer, 2002).

**RESULTS**

In order to test whether Healing Touch improved outcomes in anxiety reduction and cardiovascular variables, dependent t-tests were conducted for state and trait anxiety, heart rate, and systolic and diastolic blood pressure. Statistical significance was accepted if \( p < .05 \).

**Psychological Effects**

State anxiety ratings (Table 1) decreased significantly from pre to post Healing Touch in all three sessions: session one \( t (7) = 3.41, p = .011 \); session two \( t (7) = 2.80, p = .026 \); session three \( t (7) = 2.55, p = .038 \). Trait anxiety ratings did not demonstrate a statistically significant decrease from pre to post Healing Touch in any of the sessions; although session one and two did show modest decreases.

**Physiological Effects**

Heart rate data for sessions one and two showed decreases from pre to post, however, these were not statistically significant. Blood pressure data analysis showed a moderate...
decrease in all three sessions; however these decreases were not statistically significant.

Table 1: State and Trait Anxiety Levels Pre and Post Healing Touch Sessions.

<table>
<thead>
<tr>
<th></th>
<th>Pre Mean ± SD</th>
<th>Post Mean ± SD</th>
<th>t</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>state anxiety</td>
<td>33.13 ± 8.49</td>
<td>25.75 ± 8.00</td>
<td>3.41</td>
<td>.011 *</td>
</tr>
<tr>
<td>trait anxiety</td>
<td>33.88 ± 8.85</td>
<td>33.13 ± 9.23</td>
<td>.46</td>
<td>.656</td>
</tr>
<tr>
<td>session 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>state anxiety</td>
<td>30.00 ± 7.41</td>
<td>23.63 ± 3.66</td>
<td>2.80</td>
<td>.026 *</td>
</tr>
<tr>
<td>trait anxiety</td>
<td>34.00 ± 7.71</td>
<td>32.25 ± 8.50</td>
<td>1.49</td>
<td>.180</td>
</tr>
<tr>
<td>session 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>state anxiety</td>
<td>30.63 ± 11.49</td>
<td>24.25 ± 5.26</td>
<td>2.55</td>
<td>.038 *</td>
</tr>
<tr>
<td>trait anxiety</td>
<td>31.88 ± 7.00</td>
<td>32.63 ± 8.05</td>
<td>.92</td>
<td>.390</td>
</tr>
<tr>
<td>session 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* denotes statistical significance
Standard deviation (±) is rounded to two decimal places

Qualitative Comments
Of the eighteen comments recorded, seventeen comments used descriptive words like “relaxing”, “good”, “enjoyable” or “feel better” to describe the Healing Touch session. Two participants reported feeling physical sensations and used descriptors such as feeling “tingly” and “pressure”. One participant reported the physical sensation of the lower legs being dropped down, “something’s being released in the legs”. One participant reported an on-going physical pain being significantly reduced over the course of the session. Three participants reported the sessions helped reduce “mind chatter” and aided in “clearing my thoughts”. One participant reported the sessions felt “like meditation”.

DISCUSSION
This research investigated if Healing Touch would have a positive psychological and physiological effect on the participants. The results indicate that participants experienced a statistically significant reduction in state anxiety levels and these results compare well to studies reporting similar findings for Healing Touch to induce a relaxation and stress reduction response.

Although not statistically significant, heart rate and blood pressure decreases were seen; variables which may decrease when an individual is relaxed. The participants in this study were students of a Sport and Recreation degree. It could be assumed these participants were significantly more physically active than the average person and therefore had developed some of the benefits of being physically active such as lower blood pressure, lower heart rate, and lower anxiety and depression levels (American College of Sports Medicine, 2000).

The qualitative comments provided by participants support the ability of Healing Touch to induce relaxation and ‘good feelings’ associated with being in a relaxed state. These comments also allow some insight into the participants’ experience of the Healing Touch session. It is well documented that emotions and beliefs can create physiological changes in the body. For example, the stress associated with undergoing a medical procedure is known to produce physiological changes. As shown in a review of the studies on Healing Touch, Wardell and Weymouth (2004) suggest future research into the effectiveness of this complementary therapy may also have positive outcomes for reduced medical costs, lower pharmaceutical use, and a shorter length of stay in hospitals. Comments from the participants regarding the reduction of ‘mind chatter’ compares well with the reduction seen in state anxiety levels; participants found the sessions relaxing mentally and physically.

The limitations which affected the depth of this study included equipment failure in heart rate data collection for two participants during session one, time constraints reducing the number of Healing Touch sessions for each participant to three, and the small number of participants involved in the study. No data was collected regarding the participants physical activity levels prior, during, or after the study. The effect the Healing Touch practitioner had on participants during the sessions was not analysed or measured.

In spite of these limitations, the results from this research suggest that Healing Touch promotes relaxation in psychological and subjective domains and may prove a useful and effective therapy for anxiety and stress reduction. Although the exact mechanism Healing Touch uses to induce this response remains unknown to current scientific knowledge, further research using both quantitative and qualitative measures opens up exciting future research opportunities for those in the medical and complementary therapy fields.
The effect of Healing Touch

Student researcher reflections

Conducting this research gave me an opportunity to delve into my interest of the use of alternative therapies to enhance people’s wellbeing. I was able to briefly marry Healing Touch to current psychological and physiological data collection methods, and I enjoyed mixing my interest in alternative therapies and attempting to capture its essence through scientific means. I learnt the importance of seeking help when I needed it and that failures were opportunities for me to learn from. The skills I practiced that have relevance to my profession were communicating with people clearly and concisely, academic writing skills, and using an analytical approach when reading research articles. I also became very proficient at taking blood pressure. The support I needed from the supervision process consisted of verbal discussions to ‘bounce’ ideas off the supervisor regarding methodology, and support when analysing the results and establishing statistical significance.

References

Effects of Music Tempo on Cycling Performance

Shontelle Dixon, BSR,* and Duncan McKenzie, Dip PE, M.Ed(PE) *

Objective: Analyse the effect of music tempo during exercise on cycle cadence and heart rate.

Design: Experimental research.

Setting: Cycle ergometer testing in the Human Performance Laboratory, Department of Sport and Exercise, Southern Institute of Technology, Invercargill, New Zealand.

Participants: Nine non-trained and two trained cyclists, (11; mean ± SD; Age (years) 30.36 ± 7.92, Height (cm) 174.08 ± 11.16, Weight (kg) 75.5 ± 13.45).

Main Outcome Measures: Analysis of music tempo (BPM - beats per minute), cycle cadence (RPM - revolutions per minute) and heart rate (HR - beats per minute).

Results: Changes in music tempo resulted in corresponding changes in cycle cadence. Heart rate measures showed a linear relationship to increasing exercise duration and participants voluntarily selected workloads that held heart rates to sub maximal levels.

Conclusions: For participants cycling at self-chosen work-rates (sub maximum heart rate range), changes in music tempo resulted in corresponding changes in cycle cadence.

Key Words: music tempo, cycle cadence and heart rate

BACKGROUND

Musical tempo can influence how a piece of music is appraised and may directly influence how the individual physically responds to the music (Elliot, Carr, & Orme, 2005). Waterhouse, Hudson, & Edwards (2010, p. 662) conclude that healthy individuals performing sub maximal exercise not only worked harder with faster music but also chose to do so and enjoyed the music more when it was played at a faster tempo. According to Bernatsky et al. (2004), music can improve mood state, increase arousal, and provide a reduced feeling of fatigue. The influences of music in the fitness industry appears well known and the addition of music to exercise can be seen as similar to that of an ergogenic aid (Karageorghis & Priest, 2008). Implications for exercising with music and in improving training programmes are immense (Copeland & Franks, 1991; Yamashita et al, 2006; Schie, Stewart, Becker, & Rogers, 2008).

The aim of this research was to analyse effects that music tempo (BPM- beats per minute) had on cycle cadence (RPM- revolutions per minute) and heart rate (HR).

METHOD

Nine non-trained and two trained cyclists, cycled at self-chosen work-rates while listening to music. Participants (11; mean ± SD; Age (years) 30.36 ± 7.92, Height (cm) 174.08 ± 11.16, Weight (kg) 75.5 ± 13.45) performed a warm up on a Monark Ergometer Model 828E at a self selected load for 5 minutes. The cycle test required the participants to undergo a maximum of 25 minutes of cycling on a VeloTron™ Cycle whilst listening to music. Subjects were tested on two occasions. Each time they were tested, the only variable that changed was the version of music. Testing was completed one week apart, and the visits took place at the same time of the day. Limited instructions were provided during the test so that participants would select their own work-rates.

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Figure 1: Tempo (in beats per minute) of the songs in Test One and Test Two.

Males rode at a load of 150 Watts and the females rode at a load of 120 Watts. Headphones were worn and music was played through an 8gb I- Pod (4th Generation), with the volume of the
music kept to a level between 60dB-75dB considered a comfortable level to listen to music. This level also allowed for minimal distractions from external noises. The load was controlled by use of the VeloTron™ CS (coaching software) 2008. During the cycle test, RPM and HR data was recorded at one minute intervals. Testing was carried out at the Southern Institute of Technology, Human Performance Laboratory, Invercargill, New Zealand. Subjects were also provided with an information pack, consent form and a health screening questionnaire. Ethical approval was obtained from the Southern Institute of Technology School of Health, Exercise and Recreation Ethics Committee. Microsoft Excel 2007 was used to store all of the raw data and to calculate means and standard deviations. IBM SPSS Statistics Version 19 was used to calculate statistical significance.

RESULTS
Heart rates for the males (n = 6) started off at 122 ± 9.71bpm (Test One) and 121 ± 13.44bpm (Test Two) and finished at 149 ± 29.81bpm (Test One) and 154 ± 29.32bpm (Test Two). Heart rates for the females (n = 5) started off at 135 ± 16.21bpm (Test One) and 133 ± 13.23bpm (Test One) and 133 ± 12.87bpm (Test One) and 161 ± 19.20bpm (Test Two).

There was a strong relationship between BPM and RPM (Figure 2) throughout Test One. While the values are not exactly the same, the pattern was similar throughout the test. Correlation was significant the 0.01 level.

![Figure 2: The average cadence (in revolutions per minute) in Test One.](image)

DISCUSSION
This study found that increases in the music tempo (BPM) resulted in increases in cycle cadence (RPM). Decreases in the music tempo resulted in decreases in cycle cadence. This is consistent with the findings of Waterhouse, Hudson, & Edwards (2010).

Heart rate during exercise tended to increase as exercise time increased. These results show that participants heart rates were in a submaximal range and there was a linear progression in heart rate with exercise time.

CONCLUSION
Music tempo did influence participants’ cycling performance. Cycle cadence (RPM) did follow the same trend as music tempo (BPM). When the tempo was slower, participants naturally selected to pedal slower, and when the tempo went faster, participants naturally selected to pedal faster.

Heart rate measures showed little relationship to music tempo. Heart rate followed a linear trend with increasing exercise duration and participants voluntarily selected a cycle cadence that held heart rates to submaximal levels.

![Figure 3: The average cadence (in revolutions per minute) in Test Two.](image)

References
My research project has probably been one of the hardest tasks that I have had to complete since starting at S.I.T in 2008. Along the way I learnt and improved on many skills that would help with my future, one of the most important being the value of time itself and the need to manage it so well. With help from tutors along the way, my academic writing excelled beyond the level that I thought capable. Being able to stand in front of my peers and tutors, and feel confident in what I was talking about has also improved. Having good support around me was a big decider on how successful the project was going to be. Without the research assistants (fellow students and friends) the testing aspect would have never got underway. It just showed that many hands DO make light work.

Being able to cross over aspects of the graduate profile allowed me to work on those aspects all at once, and this for me was a more successful way of striving towards the graduate profile. The Graduate profile is very relevant in my current role as teacher of Ki O Rahi at Sport Southland.

The class tutor had an important role of leadership and day to day supervision. The sessions with the mentor not only got the industry contract sorted, but allowed for interesting discussion around the research process.
An encapsulation of concussions amongst elite junior New Zealand ice hockey players

Aaron Amundrud, BSR,* and Hennie Pienaar, M.Sc.*

Objective: To determine concussion rates and identify the probable factors contributing to these injuries amongst New Zealand ice hockey players aged 16 to 20 years.

Design: Structured non-disguised questionnaire.

Setting: The questionnaire was presented to members of the 2011 and prospective members of the 2012 New Zealand Under 20 Ice Hockey Teams.

Participants: 15 junior national team representatives.

Main Outcome Measures: Bivariate analysis of the closed and open-ended questionnaire.

Results: During the 2011 season the concussion rate was calculated to be 5.5 concussions per 1000 player game hours. Overall, 26.67% of subjects (4 of 15) reported suspected hockey related sustained concussions. None of the concussions occurred on home ice, 50% were sustained at a neutral site and 50% during away games. One hundred percent of concussions occurred along or near the boards and 75% of concussions occurred while the subject's team was moving the puck out of the defensive zone. All concussions occurred while players were passing or receiving a pass and 50% of players still suffered from concussion symptoms upon returning to normal game play.

Conclusions: New Zealand concussion rates were consistent with those from related studies in the literature. Changes in philosophy of play and comprehensive instruction in personal assessment could potentially lower concussion rates and the percentage of the population affected. Proper implementation of the suggested Graduated Return to Play Protocol is essential to ensure player safety.

Key Words: concussions, ice hockey, New Zealand, injury mechanisms, return to play

BACKGROUND

Ice hockey is an extremely fast sport with frequent physical contact. Head injuries, specifically concussions, pose a serious risk to participants. On January 8th, 2011 the concussion issue became central to the sport of ice hockey with the announcement that Sidney Crosby, arguably the sport’s most globally recognized athlete, had suffered a concussion and would end up missing the remainder of the 2010-11 season (Gulli, 2011).

During the International Ice Hockey Federation (IIHF) Division III Under 20 World Ice Hockey Championships hosted in Mexico City from 9 – 18 January 2011, several New Zealand players were suspected and treated as having sustained concussions during the six game tournament. The aim of this study was to determine concussion rates amongst New Zealand ice hockey players aged 16-20 years and the factors that may contribute to these injuries.

METHODS

An ice hockey specific questionnaire based on a National Collegiate Athletic Association Injury Surveillance System (NCAA ISS) injury form was developed so players could self-report on previous concussions and the circumstances related to these incidents. All subjects of the present study were recruited by means of formal invitation and were members of the 2011 New Zealand Under 20 National Men’s Ice Hockey Team or recognized as being prospective team members in 2012 (New Zealand Ice Hockey Federation, 2011).

The present study had ethical approval from the Southern Institute of Technology’s Research Ethics Committee prior to commencement and complied with the ethical standards of the Southern Institute of Technology, the 1993 Privacy Act, and the 1994 Health Information Privacy Code. Permission was also obtained from the New Zealand Ice Hockey Federation prior to the study’s commencement.

Descriptive characteristics of the subject group were as follows: age 18.0 ± 1.0 years, height 180.6 ± 6.2 cm, body mass 77.5 ± 8.3 kg, and full contact playing experience 5.1 ± 1.4 seasons.

Results were analysed using IBM SPSS (v. 19) statistical software package to determine the statistical significance between the independent
variable, ice hockey related concussions, and numerous dependent variables.

For the purpose of calculating the rate of concussions per 1000 player game hours (player-hours), the assumption was made that the average 2.2 game hours per week reported by participating players equated to 1 game per week (1 game consists of sixty minutes of start/stop playing time, spanning over approximately 2.2 hours of actual time). To calculate how often game concussions occur (number of player hours per concussion), the following formula was applied:

\[
\text{rate of game concussions per 1000 player-hours} = \frac{(\text{number of game(s) per week})(\text{weeks per month})(\text{season length in months})(\text{number of players})}{\text{(total number of concussions)}}
\]

This sum was then divided into 1000 to calculate the concussion rate for games per 1000 player-hours.

**RESULTS**

The concussion rate for the 2011 season was 5.5 per 1000 player-hours, and the rate over a player’s entire contact playing history was 2.4 per 1000 player-hours. In total, four of fifteen (26.67%) subjects had sustained one or more ice hockey related concussions over their playing histories.

All concussions were sustained during games, and no concussions were sustained on home ice. Seventy five percent of concussions occurred during offensive play. All concussions were described as direct blows to the head. Fifty percent were attributed to contact with the environment (ice and boards). Fifty percent were attributed to a combination of player and environmental contact. All concussions occurred along the boards; 75% in the defensive zone, on the left-hand side of the ice; 50% occurred between the top of the face-off circle and the blue line in the defensive zone. Seventy five percent of players were passing when concussions occurred, while 25% was receiving a pass when the concussion occurred. In 75% of the instances no penalty was awarded to an opposing player for plays resulting in an injury.

The most commonly experienced symptoms in order of highest occurrence were dizziness (in 4 incidents), headaches (in 3 incidents), confusion (in 2 incidents), and loss of balance (in 2 incidents).

Seventy five percent of players had only missed the 1-2 days directly proceeding concussion injury before returning to normal action. Seventy five percent had rested, and 50% had performed light exercise before returning to game play.

**DISCUSSION**

The 2011 concussion rate of 5.5 per 1000 player-hours for New Zealand players was comparable to Canadian university players (4.2), elite amateur athletes (6.6), and amateur hockey players over 18 (4.6 to 6.0) as reported by Marchie and Cusimano in 2003 and presented in Figure 1. The concussion rate during games of 2.4 per 1000 player-hours over a player’s entire contact ice hockey history were also comparable to findings published between 1966 and 1997 for players aged 5 to 17 years of age, where secondary school players had a concussion rate of 2.8 per 1000 player-hours (Marchie & Cusimano, 2003, p. 125).

![Figure 1: Comparison of concussion rates.](http://sitjar.sit.ac.nz)

1 - University players (Marchie & Cusimano, 2003)
2 - New Zealand Juniors (present study)
3 - Canadian amateurs over 18 (Marchie & Cusimano, 2003)
4 - Elite amateur athletes (Marchie & Cusimano, 2003)

The percentage of elite junior New Zealand ice hockey players sustaining concussions (26.67%) is comparable with that of players in the Swedish elite league (22%) (Tegner & Lorentzon, 1996, p. 252). This is considerably lower than that of similar aged fourth tier ice hockey players (mean age 18.2 ± 1.2 years) who participated in the Hockey Concussion Education Project (41.5%), (Echlin et al, 2010, p. 2, 4), (Figure 2).
Concussions amongst elite junior NZ ice hockey players

Figure 2: Comparison of concussion percentages between different populations.
1 - Swedish Elite League (Tegner & Lorentzon, 1996)
2 - New Zealand Juniors (present study)
3 - Canadian Tier 4 Juniors (Echlin et al, 2010)

Since all of the concussions occurred at away or neutral site venues, players may be more vulnerable on unfamiliar or less familiar ice surfaces.

In this study 50% of concussions were reported to be the result of player contact and 50% due to a combination of player contact and contact with the environment. Similarly, the injury mechanisms responsible for causing concussions amongst NCAA ice hockey players were contact with another player (60.2%) and contact with boards/ice surface (33.4%) (Agel, Dompiere, Dick & Marshall, 2007, p. 246). Differences in the fore mentioned findings are likely due to the substantial disparity between population sizes between studies.

A cultural and philosophical shift from contact predisposing players to injurious plays to ‘clean plays are the best plays’ could lower concussion rates in the sport (Sporting News, 2011). Placing a greater emphasis on how to receive body check-ups could also prove beneficial to players by lowering injuries in the “danger zone” (an area 2 to 4 feet away from the boards which encompass the ice surface) (Hockey Player Magazine, 1997).

Players should also be informed of concussion ‘hot spots’, areas or game situations in which concussions readily occur. When players are in the ‘danger zone’, players who are on their ‘off wing’ or unnatural side and players who are making or receiving passes when coming out of the defensive zone should exercise caution and be prepared to safeguard themselves.

The percentage of players reporting headaches (75%) resembled the findings of Benson, Meeuwissee, Rizos, Kang and Burke (71%), (Benson et al., 2011, p. 907).

Attention must be paid to players who are involved in contact to identify symptoms that may exhibit concussion. Players should be removed from play if suspected of sustaining a concussion, and not be returned to play without medical clearance or the proper progression through the return to play protocols. The Graduated Return to Play Protocol consists of the following six steps: 1) complete physical and cognitive rest, 2) light aerobic exercise, 3) sport-specific exercise, 4) non-contact training drills, 5) full contact practice, and 6) return to normal game play (McCrory et al., 2009, p. 39).

It should be noted that the present study’s reliability might be challenged due to the influence of a small sample size on the statistical strength. However, the findings should possess a high degree of validity, since the collected data was self-reported and the questionnaire used was adapted from the NCAA Injury Surveillance System injury questionnaire.

CONCLUSION

Concussion rates amongst elite New Zealand ice hockey players are comparable to those of other nations. Contributing factors to serious ice hockey specific injuries, as played in New Zealand includes: being monitored while sending and/or receiving passes, possessing the puck along the boards, playing at unfamiliar venues, and transitioning from the defensive to offensive zones.

Possible solutions could involve monitoring current information and international trends in the sport and responding with a change in the philosophy of play. It is important that current information on concussions and recommendations for treatment are accessible to all levels of play, so that the wellbeing of those participating in the sport is safeguarded.

Integral to proper concussion management is 1) accurate and proactive assessment and 2) proper and timely progression, or regression if necessary, making use of formal return to play protocols. Identifying concussions is not a difficult or a complex process when making use of the Sport Concussion Assessment Tool (SCAT) 2 tool. Similarly, the return to play protocol, consisting of six 24 hour steps, is simple to follow. Both the SCAT2 and return to play...
protocols can be applied to athletes in any sport subject to sustaining concussions. Concussions in New Zealand ice hockey requires further investigation, due to the seriousness of harm posed to players that still exist along with current concussion management practices that could be improved.

References

Through conducting this research not only did I gain knowledge about sports concussions, but more importantly developed my own problem solving skills. I now appreciate and enjoy the research process of gathering information and processing it for the purpose of developing relevant solutions to real issues. As an Injury Management Officer for one of New Zealand’s largest employers, the research skills acquired and developed during the Bachelor of Sport and Recreation programme aid me in finding solutions to limit injury occurrence and severity as well as to provide effective treatment and rehabilitation strategies. All staff members of the Sport and Recreation Department were instrumental in the development of my skills as a researcher through their quality instruction and ability to relay personal experiences conducting research or utilizing research skills.