



A touch of sugar: A multimedia case study to facilitate student dietitians learning about the clinical management of diabetes

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This paper describes the development, implementation and evaluation of a multimedia case study on dietetic case management of diabetes. A multimedia web-based program was developed to use the interactive capacity of the web-based environment to enable student dietitians to develop the skills of clinical reasoning and to trigger their learning about the nutritional management of diabetes. A case study of a person with diabetes was developed using a simulated medical history, video clips and sound clips. The students were asked to manage the patient online by responding to the patient's questions, attending a team meeting and outpatient clinic, attending to food service tasks and responding to visual cues. Tutors were able to access the student's responses to submissions online. Evaluation of the program was by questionnaire, which gathered quantitative and qualitative data on the student's perceptions of their experiences in using the web-based case. The students rated the content and the interactive parts of the case highly but experienced technical difficulties and found the case took too much time to complete.

Introduction

Traditionally student dietitians have learned clinical reasoning skills on placements in hospitals and other clinical settings. The clinical environment has many advantages and is expected to remain the cornerstone of dietetic training but as others have acknowledged, there are also a number of limitations to learning in the clinical environment (Higgs & Edwards 1999 p91). The clinical setting understandably revolves around the needs of the patients rather than the students so the educational experiences are often ad hoc rather than planned. The learning is frequently fast paced thereby limiting the time required for reflection. Additionally the clinical environment does not tolerate mistakes that may

put patients at risk. In view of these issues computer mediated learning may provide a complementary opportunity for students to develop their clinical reasoning skills. Learning in the virtual online environment provides a safe environment that tolerates mistakes, allows students to work independently at their own pace and allows sufficient time for reflective practice.

Clinical reasoning refers to the thinking and decision making processes associated with clinical practice. Heath (1990) states that health professionals should be able to absorb information through the various senses and assess the validity, reliability and relevance of this information. Higgs and Jones (1995) contend that the three core elements of clinical reasoning are the use of knowledge, the act of thinking and the process of awareness and monitoring of thinking. This case study was developed with the aim of incorporating these three core elements.

Raidl et al, (1995) state that student dietitians can gain greater flexibility, independence and control over their learning, develop a higher level of confidence and comfort using computer technology and develop the potential to develop sharper critical thinking skills through computer simulations and interactive case studies. Hence a web-based environment rather than text was chosen for the case study.

The major gains for teaching and learning from using technologies have been defined by Bates as improved access, consistent quality and increased cost effectiveness (1997). In addition to this by incorporating technology into the course students are prepared for their future employment where increasingly sophisticated technology is now an integral part of the workplace.

This paper describes the development, implementation and evaluation of a multimedia case study on dietetic case management of diabetes.

Methods

Development of the case

This case study was developed for the Deakin University Master of Nutrition and Dietetics (MND) Course, which prepares students to work as dietitians and has a very practical focus.

The members of the project team who convened to develop the case, provided expertise and skills in diabetes, dietetics, web-based programming, graphic design, educational design and technology evaluation. Two student representatives were also involved in an advisory capacity. Reflections from the team after project completion revealed that

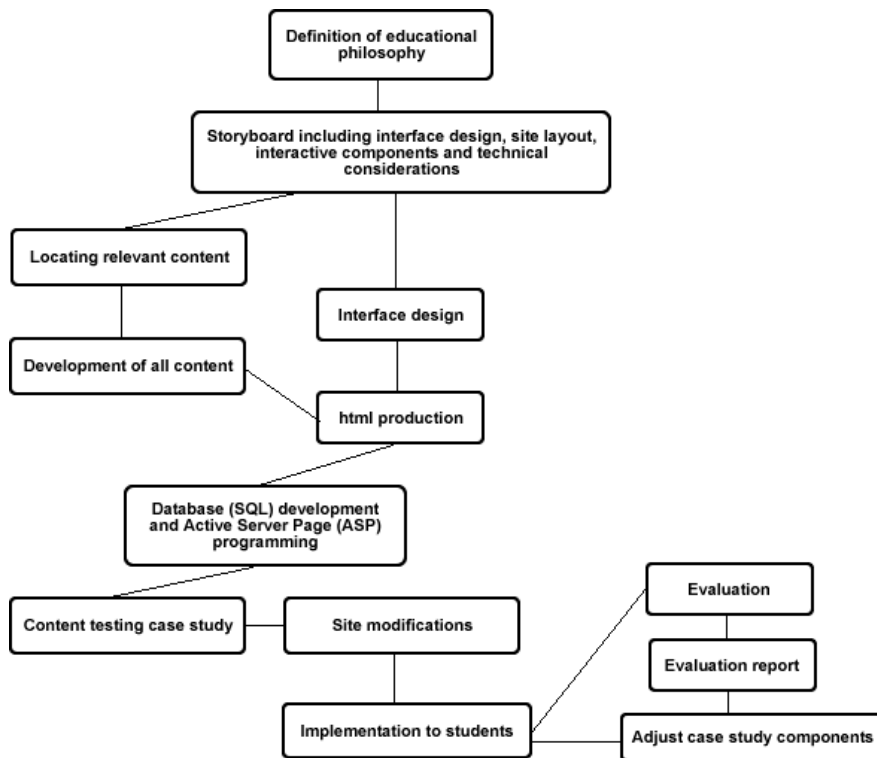


Figure 1: The process of design, production and evaluation of the case study

a key element to effective cross-functional teamwork was the ability of the project leader to act as the 'interpreter' between the academic and the web development team members. Alexander and McKenzie (1998) describe benefits to staff flowing from their involvement in information technology projects and our team certainly experienced these in terms of improved understanding and skill in the use of information technology. Our experience was that a *small* team was effective in completing the project. According to Fournier (2000) E-business development also works best with small project teams.

Figure 1 outlines the process of the design, production and evaluation of the case study.

The aim of this project was to use the web environment in a dynamic and interactive fashion to help students develop the skills of clinical reasoning. When working through the case students were asked to:

- *identify learning issues* by thinking about what they already knew and what they needed to know to successfully manage this case,
- *identify key information* by working through the case to identify the valid, reliable and relevant information,
- *reflect on their own practice* by comparing their responses to a practicing dietitian's response.

Holli (1997) describes reflective practice through journal keeping as 'allowing us the opportunity to step back from the action to record our impressions, feelings and thoughts. When we look back to what we have recorded we can use the journal, not just as a means of recall, but as a measure of the changes that have occurred in our understanding'. Email and web based discussion groups are used throughout the MND course for the students to share reflective journals with their mentors and peers. Reflective practice is a key component of the Accredited Practising Dietitian's Program hence this was incorporated into the web based case. Electronic networks have been used successfully to promote reflective practice in student teacher programs according to Bodzin (2000).

Educational philosophy

The educational philosophy underpinning the case study was defined at the commencement of the project to ensure that all members of the project team had a clear understanding of the desired approach of the case. It was decided that a primary aim of the case study was to create a learning environment that was student centred, self directed, interactive and situated (i.e. the students would learn about diabetes in a clinically relevant context). This was in keeping with the overall philosophy of the course which is based on PBL (problem based learning) as outlined by Albanese and Mitchell 1993. As Davis and Harden (1999) state, the trigger case used in PBL should be relevant to the students' future practice as health care professionals. PBL trigger cases should be authentic prototypes according to Albanese and Mitchell (1999:71-72). This particular trigger case was developed in collaboration between the academic staff and expert clinical staff from a nearby hospital.

Technical development

The case study utilises a combination of static html web pages enhanced by the selective use of Active Server Pages (ASP) linked to a purpose designed and built SQL database. A range of short video and audio clips

were delivered using the Apple Quicktime plugin. A Discussion Group forum was provided via a specific CMC (Computer Mediated Communication) system. The SQL database was utilised to store and retrieve student submitted results. The database enabled students to submit decisions and personal reflections and then return at a later date to retrieve results and continue working within the online case study.



Figure 2: Meet Peter Kelly. The student is able to access a video clip of a dietitian meeting Peter in hospital. Peter poses some questions for the student to respond to via their personal reflections.

Implementation of the case

In the second year of the MND course students completed an 11-week problem based learning (PBL) block. Albanese and Mitchell (1993) have defined PBL as, "a way of developing a powerful learning environment by using a case as a trigger for students to develop learning issues around a topic". Each week the students were presented with a case study that triggered their learning in a specified topic. Most of the cases were text-based but for the diabetes topic the web-based case described in this paper was used. The students were challenged to apply their theoretical knowledge of diabetes to a practical situation by working through a realistic case of a person with diabetes. This included the need to identify

visual and verbal cues from the 'virtual' patient (see Figure 2), the dynamic medical record (see Figure 3) and interpretation of information from other sources typical of a hospital setting such as food service and team meetings (see Figure 4). The students were asked to respond to issues such as the patient experiencing hypoglycaemia and challenges to confidentiality. Other topics covered included the role of the dietitian, dietary assessment, nutrition education, exercise, self-blood glucose monitoring, diabetes education, prevalence and prevention of diabetes.



Figure 3: *Dynamic Medical Record*. As the student works through the case further sections of the medical record are able to be accessed. The student experiences consequences of their decisions. For example, if Peter's menu is submitted in its existing form he experiences hypoglycemia. The student is then presented with a video of Peter describing his hypoglycemia. The student is asked to choose foods from a cupboard to help Peter return his blood glucose levels to normal.

Incorporated into the case study were directions for further self-directed research and links to diabetes resource web sites. Immediate feedback upon submission of the student's response, in the form of a pre-programmed "expert dietitians opinion", allowed the students to evaluate

their own progress as they worked through the case. The students were asked to compare their own responses to the expert dietitian's responses and reflect on their own thinking by resubmitting via the personal reflections (see Figure 5). Students work was accessible to their tutors but was not assessed.

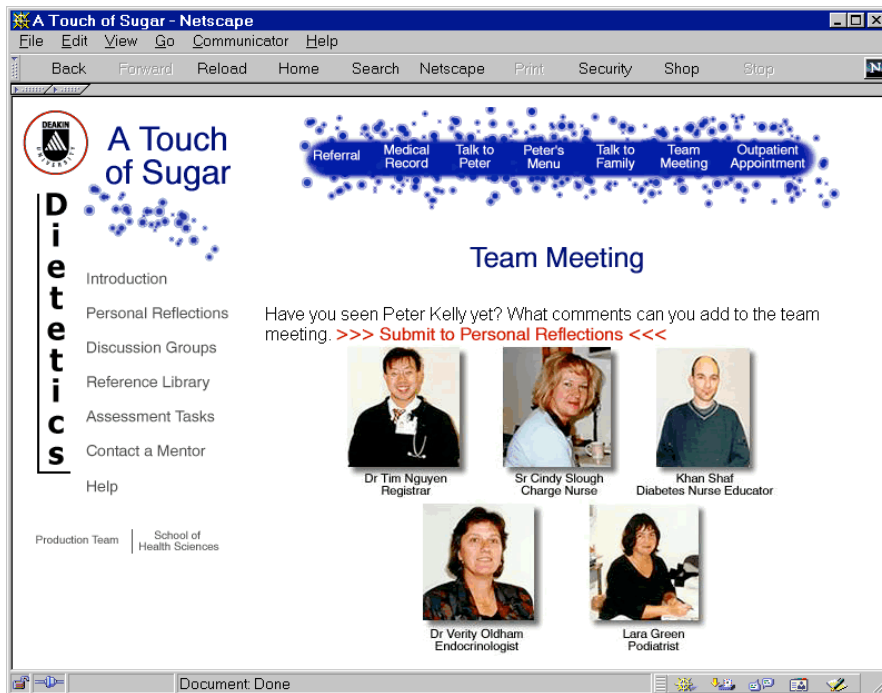


Figure 4: *Health Care Team Meeting*. The student clicks on each member of the health care team to hear a short sound clip of their summary of Peter's progress in hospital. The student is given the opportunity to contribute to the team meeting.

Evaluation of the case

A questionnaire was administered to the 35 students, 3 weeks after the diabetes case was completed to gather quantitative and qualitative data on the student's perceptions of their learning and the student's general experiences in using the case study. The students completed the questionnaire individually, which took approximately half an hour and was submitted anonymously. The students rated their learning on 15 key areas of the web-based case listed in Table 3, using a Likert scale (from 1 being extremely poor to 10 being extremely good). They were asked open-

ended questions about the best and worst aspects of the case, navigation, screen design, laboratory environment, content, time commitment and their thoughts on their ability to learn using a computer based case study.

The two staff members who facilitated the tutorials kept a reflective practice journal and met to discuss their experiences in using the case.

The screenshot shows a Netscape browser window titled "A Touch of Sugar - Netscape". The address bar is empty. The menu bar includes "File", "Edit", "View", "Go", "Communicator", and "Help". The toolbar contains "Back", "Forward", "Reload", "Home", "Search", "Netscape", "Print", "Security", "Shop", and "Stop".

The website content includes a logo for "A Touch of Sugar" and a navigation bar with links: "Referral", "Medical Record", "Talk to Peter", "Peter's Menu", "Talk to Family", "Team Meeting", and "Outpatient Appointment". The main heading is "Personal Reflections". Below it, there is a link "Submit any General Reflections here..." and a prompt "Select the number of the entry you wish to view.".

Entry No.	Date	Title	Expert Opinion
1	6/5/00 10:40:00 AM	Type of Diabetes	Type of Diabetes
2	6/5/00 11:06:00 AM	Confidentiality	Confidentiality
3	6/5/00 11:13:00 AM	Who is at Risk of Diabetes	Who is at Risk of Diabetes
4	6/5/00 11:14:00 AM	Who is at Risk of Diabetes	Who is at Risk of Diabetes
5	6/5/00 11:15:00 AM	Who is at Risk of Diabetes	Who is at Risk of Diabetes
	6/5/00 11:26:00		

The footer of the page includes "Production Team" and "School of Health Sciences". The browser status bar shows "Document: Done".

Figure 5: *Personal Reflections*. Students submit their responses via personal reflections. The student receives immediate feedback in the form of a pre-programmed expert dietitian's opinion. The student then compares their own response to the expert opinion and reflects on their own learning.

There were 26 locations in the case study where the student could submit a personal response e.g. make a decision or perform a dietetic skill such as answering the patients question, treat hypoglycemia, check a menu or compare their response to the preprogrammed dietitians response. At the conclusion of the case study submissions were sent electronically to the tutor enabling tutors to determine the number and type of submissions made by each student.

Results

Student profile

The majority of students were female (91%). They were all enrolled on one campus and were all studying on campus in the final year of their Master of Nutrition and Dietetics (MND).

Response rate

34 out of 35 (97%) of the MND students accessed the case study and 26 out of 34 who accessed the case study completed the evaluation form (76%).

Number of submissions

There were 26 submission locations in the case study. The number of submissions each student made ranged from 0-33 (some students repeated submissions) with an average of 12.5 submissions. Table 1 indicates the number of submissions made and Table 2 shows how much time students reported spending on the case.

Table 1: Student submissions

Number of submissions	Number of students
<11	17 (49%)
11-20	12 (34%)
>20	6 (17%)

Table 2: Self reported time spent on the tutorial (hours)

Hours spent on tutorial	Number of students
less than 1 hour	0 (0%)
1-3 hours	8 (32%)
4-6 hours	11 (44%)
more than 6 hours	6 (24%)

Individual learning

Students were asked to rate their individual learning in key areas on a scale of 1-10. Table 3 outlines the responses for each topic area within the case. The mean response was greater than 6 in all topics with the highest response (7.9) relating to the role of the dietitian.

Qualitative responses

Table 4 indicates the best and worse aspects of the tutorial as identified by students. The most positive aspects were the interactive components such as videos, the team meeting, screen layout and design and immediate

feedback provided by the interactive data base-backed web environment. The major problem associated with the case identified by students was that it was time consuming (76%). Other negative aspects of the case included intuitive navigation and technical difficulties. 24% of students identified 'not being in a group' as a negative aspect.

Table 3: Self-rating of the student's individual learning in key areas of the case

The students rated their individual learning using the computer based case on a scale of 1-10 with 1 being extremely poor (n=25).

Topic	Mean (SD)	Mode
Pathophysiology /pathology of diabetes	7.4 (1.76)	8
Difference between type 1 and type 2 diabetes	7.7 (2.01)	9
Prevention of diabetes	6.6 (1.66)	8
Dietary treatment of diabetes	7.3 (1.62)	8
Medical treatment of diabetes	6.3 (1.41)	7
The prevention and treatment of a hypo *	7.0 (1.88)	7
The treatment of a hypo *	6.8 (1.70)	7
Lifestyle impact for patients managing diabetes	6.9 (1.45)	7
Impact for the families of patients managing diabetes	6.7 (1.31)	8
Team management of diabetes	7.6 (1.08)	8
Nutritional management of diabetes in a clinical setting	6.9 (1.69)	7
Issue of confidentiality	7.6 (1.5)	8
Complications of diabetes	7.2 (1.14)	8
Exercise	6.7 (1.35)	6
Role of dietitian	7.9 (1.12)	8

* n = 23

Discussion

Flexibility and access

McCann (1998) states that one of the benefits of web-based materials is the greater flexibility and reduction in barriers of time and place of study. However the hardware and software requirements of this program meant that the students were required to use the computers at the university for quick and easy access. The students found the computer laboratory

environment was not conducive to learning. The students stated that they preferred to be at home with their books and other resources, however, access to the case from home was often slow and frustrating due to the file size of the video and audio clips.

Table 4: Student perceptions of the web based case study

Positive aspects	Negative aspects
Content (92%)	Time consuming (76%)
Screen layout and design (88%)	Computer laboratory environment (60%)
Interactive components e.g. video, team meeting, receiving immediate model responses by a dietitian once student has submitted their own response. (62%)	Access/ technical difficulties (48%)
	The expectation of self directed learning (28%)
	Not being in a group (24%)

Time commitment

Academic staff expected students to do 8 hours of study over Monday and Tuesday in preparation for the clinical placement on Wednesday and Thursday. The students reported that the case study was too time consuming yet only 6 students reported spending more than 6 hours on the case. This, however, may not take into account additional reading, which related to the topic of diabetes. On average the students completed less than half the content (see Table 1). Eight students attempted the case study during the allotted tutorial time only, doing no extra work in the self-directed study time (see Table 2).

Teaching and learning environment

The students were already socialised into working in groups. They had worked on 5 previous text-based cases as groups, so working on a computer based case, in a different environment and largely working independently was a very different experience to their previous work. They missed the opportunity for peer learning. This may have been overcome by encouraging them to use the online discussion area or by working in groups.

Students did not like the lack of direction in the case study. It was set up deliberately to not give specific directions about how to work through the

case, in order to encourage students to make decisions based on clinical reasoning. Students reported finding this expectation of intuitive navigation frustrating. The students did however rate the content of the case and their individual learning on all topic areas positively.

Using technology

Some technical difficulties were experienced which were frustrating for the students and staff. Academic staff were unable to correct these problems independently. These difficulties may have negatively influenced student's perceptions of the computer-based case as well as increasing the time required to complete the case. As Thiele (1999) notes, technological problems clearly detract from enjoyment of web-based learning.

Interactivity

Lander (1999) notes that interactivity has been identified as a key element in successful online learning. Students reported learning the most from the interactive parts of the program. They rated highly the video clips of a dietitian at work and seeing the dietitian in various work situations such as a team meeting, taking a diet history, educating a client about diabetes. The benefit of multimedia is evident here where 35 students could independently observe a dietitian interact with a client at the one time. They could review the interaction and test their knowledge in relative privacy. The student could attempt to answer the client's questions without the concern of giving a client potentially misleading information. The student could take their time in preparing an answer, compare it with the dietitian's opinion and then decide to re submit their answer if required.

Academic staff perspectives

In reflective discussions after the case study the academic staff reported missing their usual role in facilitating student learning. They felt unable to troubleshoot the technical problems and missed the usual interaction with the students. It was interesting for the staff to measure how much of the case study the students attempted to complete.

Laurillard (1993) states working with technology requires a significant culture change on the part of teachers and students. It was very enjoyable for the staff to be involved in novel activities such as making videos and writing scripts but it was time consuming and took them away from other duties. Academic staff considered there was increased job satisfaction, an increased understanding of information technology and a greater insight into student learning.

Future directions

The use of computer mediated learning in tertiary courses has become increasingly common. Turner et al (2000) conclude that computer-based simulations are a promising supplement to didactic instruction and provide more varied practice experiences in preparation for more skilled entry-level positions in dietetics.

Training courses for health care professionals have traditionally relied on practice experience in hospitals and other health care agencies to facilitate the practical application of theory to professional practice. With financial pressures experienced in both health and education sectors, the opportunities to gain professional experience are becoming increasingly difficult to achieve. The learning a student will experience by actually working alongside a health professional in the workplace cannot be totally replaced. The development of "virtual experiences" such as the one described in this paper will decrease the present reliance on one-on-one learning in the external healthcare centres by allowing aspects of clinical reasoning skills to be incorporated into the university-based teaching component of courses.

In order to overcome some of the difficulties identified in the evaluation of this case study, in future, it will be supported by a CD Rom containing video and sound clips, companion instruction notes, and a strong emphasis on a collaborative approach (for example effectively utilising CMC functions). The students will be given a preparatory tutorial which outlines this mode of learning and familiarises them with the technology and layout so they feel more comfortable with learning in this way.

Conclusion

The case study placed students in a realistic situation where they had to manage a person with diabetes. They could complete the case study at their own pace and the case study gave them the opportunity to observe a dietitian at work. With the reconfigurations outlined above the technology will become more user friendly to both the tutors and students.

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Appendix 1

Evaluation of Diabetes Computer based tutorial

(Please circle the appropriate response indicating your response to the statements and add any comments you may have)

Name(optional)..... Hospital Group..... Date.....

1. On a scale of 1 to 10 (1 being extremely poor), how would you rate **your individual learning** using this computer based tutorial case according to the following criteria:

- a. Physiology/pathophysiology of diabetes
- b. Difference between type1 and type2 diabetes
- c. Prevention of diabetes
- d. Dietary treatment of diabetes
- e. Medical treatment of diabetes
- f. The prevention and treatment of a hypoglycaemic attack
- g. The treatment of hypoglycaemic attack
- h. Lifestyle impact for patients managing diabetes
- i. Impact for the families of patients managing diabetes
- j. Team management of diabetes
- k. Nutritional management of diabetes in clinical setting
- l. Highlighted issues of confidentiality that a dietitian may encounter
- m. Complications of diabetes
- n. Role of exercise in management of diabetes
- o. Role of the dietitian in the management of diabetes

Comments.....
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2. I generally enjoy working on a computer?

Strongly agree Agree Agree to some extent Disagree Strongly disagree

3. I enjoyed completing this tutorial

Strongly agree Agree Agree to some extent Disagree Strongly disagree

4. The computer tutorial was easy to use.

Strongly agree Agree Agree to some extent Disagree Strongly disagree

5. I clearly understood the purpose of the tutorial.

Strongly agree Agree Agree to some extent Disagree Strongly disagree

6. The videos in the tutorial helped my learning of the topic.

Strongly agree Agree Agree to some extent Disagree Strongly disagree

7. Indicate approximately how many hours in total you spent using this tutorial.

Less than 1 hour 1-3 hours 4-6 hours more than 6 hours

8. What were the main difficulties you experienced using the tutorial

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.....
.....

9. How would you rate the overall educational value of the software?

High medium undecided low no value

10. I would prefer to complete this computer based tutorial:

- a. Individually
- b. With a partner
- c. With a larger group

11. What were the 3 best aspects of the computer case based tutorial?

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.....
.....

12. What were the 3 worst aspects of the computer case based tutorial?

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13. Please comment on the following aspects of the computer based tutorial.

a. Navigation around site

.....

b. screen design/layout

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c. Submission of work

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d. Laboratory Environment

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e. Content

.....

f. Time taken to explore

.....

g. My learning using a computer-based tutorial

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h. Any other comments/improvements

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