

THE EVALUATION OF STUDENT PERFORMANCE AND PERCEPTION IN WEB-BASED INSTRUCTION IN REGARD TO AGE AND GENDER

¹Jones, V. and ²Jo, J.H.

School of Information Technology
Faculty of Information and Communication Technology
Griffith University

¹Email: vicki.jones@gu.edu.au

²Email: j.jo@gu.edu.au

Abstract

A research project about the use of Web-based Instruction in education was conducted at Griffith University in 1998. This educational program integrated interactive multimedia with teaching and learning theories in the form of theory-based learning strategies¹. This paper reports on the results in relation to the age and gender of the participants.

Keywords

Web-based Instruction, Age, Gender, Learning Theories, Teaching/Learning Strategies, Theory-based Learning Strategies.

1. Introduction

Using a flexible approach to education requires not only new technology but also adaptive environments to cater for the diversity of the student population. With the rapid technological developments in Information Technology in recent years and the increased and widespread use of the Internet for communication, education, commerce and entertainment, a unique global community has been emerging (Jones and Jo, 1998). Consequently, the educational culture has changed significantly, instigating a need to reconsider the way we approach tertiary education. One of the outcomes of these changes is that the restraints and barriers of distance, time, age and gender no longer hinder one's opportunities to pursue educational development. A flexible approach is a new aspect of teaching particularly in Australia's universities. With the growing need to provide high level, good quality education at a minimal cost, universities are now looking to incorporate flexible systems within the traditional settings.

In 1998, a study was conducted on the production and implementation of Web-based Instruction (WBI), which incorporated various well-known theories of education. A short course in HTML web page scripting was offered to university staff, academics and post-graduate and undergraduate students. The course was a free enrichment course which carried no academic weighting. Data was gathered and analysed in a number of ways. One aspect of the WBI system that was considered was its' effect on

¹ Strategies derived from educational theories. Teaching and learning theories refer to the various views or concepts held about how people learn, while teaching and learning strategies refer to the methods used to encourage learning. Theory-based learning strategies are also referred to as derived teaching and learning strategies.

students of different age and gender. This paper will look at the research results and responses of a group of research participants in regard to course delivery and presentation, with particular emphasis on age and gender.

By taking this particular perspective on the major research project the researchers were able to look at the implementation of a Web-based program incorporating teaching and learning (T/L) strategies, which could pervade the barriers of age, gender and distance. The age and gender of research participants were observed in order to determine any link with performance and the effect of the theory-based learning strategies.

2. Web-based instruction (WBI)

WBI is an educational approach utilising the interaction and informative qualities of the Internet (Pilgrim and Creek, 1997), and is a viable option for today's universities. It can offer students flexibility and a DP-DT, different place-different time, approach while still providing practical assistance and educator contact when needed. However, one of the issues of WBI is that, in its present state, it is not flexible enough to suit all students. It is just as important to apply T/L strategies in WBI as it is in a traditional classroom, applied by a teacher. The T/L strategies used were derived from research into current educational theories of teaching and learning.

Many universities are now investigating and implementing WBI (Eaton, 1996). There is also much research being carried out about how this should be done (Bell and Lefoe, 1998; Wild and Omari, 1996; Updegrave, 1995) using flexible learning, collaboration, online education and virtual campuses. Much of the current research looks at the inclusion of interaction, flexibility and student involvement as strategies used to improve the quality of course delivery. However, the derivation of strategies from current educational theories is another possible approach. Some of the innovators in this field include Carswell (1997), Dalgarno (1998), McMahon (1997) and Montgomery (1995) who are researching the integration of theories of education with Internet technology.

Meeting the needs of the broad range of students who attend tertiary institutions is a constant challenge for the education system. The use of WBI has provided the educational community with the opportunity to fulfil these needs. Some of the benefits of WBI include:

- Self-paced progress - students working at their own pace
- Choice of location - students working in their choice of location
- Choice of session time - students working at a time of their choice
- Electronic communication with lecturers and other students.

In developing a course of WBI there is always the risk of creating a product which may provide all the necessary content but lack the interactivity needed to motivate students into self-disciplined study. Without in-built learning structures the product becomes one of "electronic page turning", in which the paper-based teaching material is merely replicated on a web page, resulting in what appears to be an electronic book. The student reads the web page then clicks a button or arrow to move to the next

page. In this way the Web is only being used as a means of presenting information, not to its' full potential as the technological innovation which it is (Ring, Jadav and Pagram, 1997). To make WBI more successful, educators and content designers need to develop efficient ways to formulate teaching materials for WBI, while also considering the needs of students coming from diverse and dissimilar backgrounds.

3. Research method

The learning theories investigated during this research include behaviourism, cognitivism and constructivism. To increase the effectiveness and efficiency of WBI, theory-based learning strategies were incorporated using principles and guidelines developed through this research. Through questionnaires and focus group interviews, this research has attempted to find a link between age and gender and how well students respond to WBI which incorporates theory-based learning strategies.

3.1 Online Teaching and Learning Principles

Constructivism involves the construction of conceptual knowledge and understanding (Kent, 1995) from one's own perception and interpretations of the environment. Active involvement within a learning environment can contribute significantly to a student's level of understanding (Ohlund, 1997). In an endeavor to encourage a more active involvement, the following principles and guidelines (Table 1) were developed for use in WBI. The belief was that having meaningful and relevant subject matter relating to or drawing on previous knowledge would help develop the learning skills needed for a better understanding. These principles and guidelines were developed to assist in achieving positive online teaching and learning outcomes, encourage the active construction of meaning necessary for a student to achieve deep learning and to guide students in the learning process. Jones expanded and explained these principles in more detail, in her research thesis (Jones, 1999).

Table 1: Online teaching and learning principles and guidelines

Principles	Guidelines
Clear goals and objectives	Clear objectives must be set at the start of the lesson.
Easy access to information	The information must be easy to access, possibly by using hyperlinks and improved navigation.
Active involvement in the learning process	<ul style="list-style-type: none"> • Visual representations should be used to help students concrete abstract concepts. • Visual and verbal prompts should be used to increase understanding.
Active construction of knowledge	<ul style="list-style-type: none"> • Reinforcement in the form of quizzes and self-tests should be used to allow the student better control of their own learning • Active involvement should be encouraged by setting exercises to practice new concepts and theories

These principles and guidelines were integrated into the development of the model used for implementation.

3.2 Online teaching and learning model

The study was composed of two groups of students of randomly varying ages, gender, and background. The Internet was utilised for online course delivery. The course was conducted over a period of four weeks. It was essentially online, consisting of tutorials and exercises complemented by the use of email for teacher contact, and weekly computer laboratory access with teacher presence. The teaching environment took the form of a web site, for teaching the basics of HTML, in which tutorial notes and exercises were presented in weekly sections. Both groups of students were able to work through the course in a *linear* manner or use it in a *non-linear* fashion by using hyperlinks to move to the topic of their interest.

4. Experimental model design

Information about student perception of the course was gathered through questionnaires. The learning performance was evaluated based on the results of multiple-choice questions, included in the questionnaires, about HTML subject knowledge. After completion of the course, focus groups were conducted to gather information about student attitude, opinions and suggestions.

Each group received a different learning mode, one that incorporated the T/L strategies derived from this research, and one that incorporated traditional T/L strategies. This was in order to determine whether the derived strategies could contribute to improved student performance and perception in WBI. Group G_A's course was chunked and included hyperlinks and examples. Group G_B's course included strategies adapted from the principles and guidelines shown in Table 1. These included self-tests and feedback, quizzes, visual and verbal representations and prompts and clear objectives outlined at the start of each lesson. Both groups were tested after completion time, using questionnaires and small voluntary focus groups.

4.1 Experimental design format

The groups (G_A and G_B) were two mixed groups of university staff, academics and post-graduate and undergraduate students. The online HTML course had no lectures or tutorials. Initially, a two-hour session was held (week one) in which a verbal and visual introduction about the course was given. An initial questionnaire used to gather demographic data, was distributed and collected, followed by the random allocation of participants into groups G_A and G_B. Following this a two-hour computer access period was made available to these students twice a week for three weeks. These sessions were not compulsory and many students chose to access the web at another location and time (DP-DT). The idea of the sessions was to allow an adequate amount of Internet access to each participant in the study. At each session, a tutor (one of the authors) was present for assistance if required.

4.2 Questionnaires and focus groups

Both groups completed a major post-test questionnaire. An email list of all the participants in the groups was prepared so that regular news and updates could be

conveyed electronically. Finally, all group members were invited to attend a focus group discussion, conducted after the course completion. Its purpose was to gather qualitative data in regard to the participants' impressions, difficulties encountered and suggestions about the course.

Implementation

The course was designed as a basic web site, with an introductory page containing hyperlinks to the *Tutorial Notes* and *Exercises*. Each set of *Tutorial Notes* provided links to the *Exercises* and visa-versa. The web site content was identical for both groups. However, because of the differing learning modes, the web pages for each group varied slightly in appearance. The differences found on the G_B group page were a reflection of the principles and guidelines set out in Table 1. A sample size of 24 participants was used. Initially the group was larger, but through time constraints of students and university staff nearly half of the participants did not complete the questionnaires. As a result the sample size was limited but sufficient to obtain a result

Data analysis and results

Demographic data was gathered from questionnaires to determine the makeup of each group in regard to age, gender and computer experience. Figure 1 represents the demographic data concerning age, while Figure 2 represents the demographic data concerning gender.

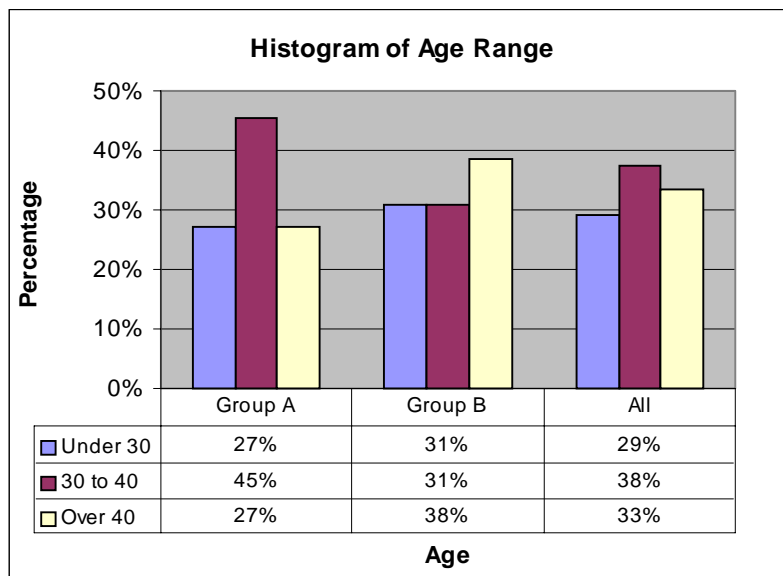


Figure 1: Age range between groups

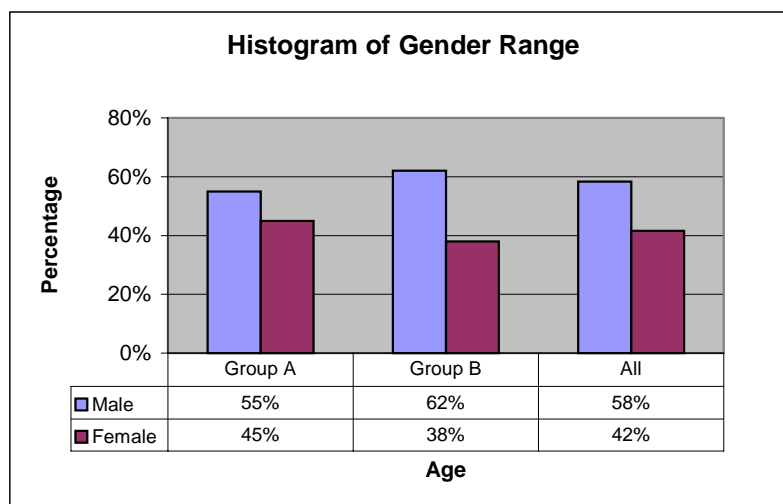


Figure 2: Gender range between groups

4.3 Demographic information

The participants in both groups were experienced computer users. With approximately 91% in group G_A and 85% in group G_B being classed as *intermediate* – they regularly used a computer for application programs such as word processing and data-base, as well as Internet and Email use. The remaining participants were classed as *advanced* (daily computer use with experience in application programs and at least one programming language).

There was a fairly homogeneous spread of age and gender within both groups. However, there was a slightly higher percentage of males. Figure 3 represents the demographic data concerning age/gender comparison. In this graph, a predominance of males under thirty, and females over thirty can be seen. However, the diversity of the student population does vary in the real world and educators have no choice in the age or gender of who will be undertaking a course.

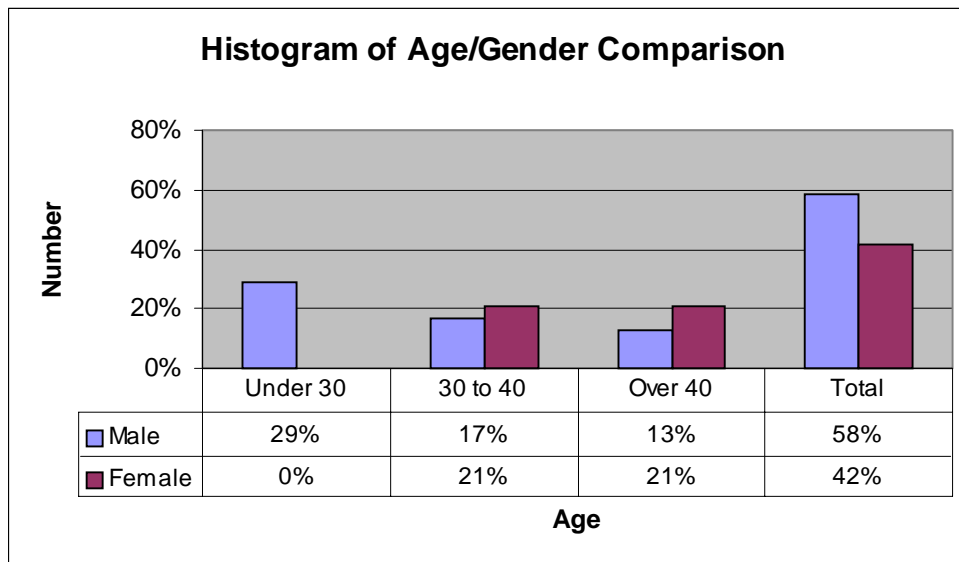


Figure 3: Age/Gender Comparison

4.4 Effect of age, gender and derived t/l strategies

Through Frequency Distribution tables and Histograms, and Gamma Correlation Analysis an association was established between the use of theory-based learning strategies and student perception. There was an overall positive response in regard to student perception of the course. However, in regard to perception about how much they had learnt during the course, group G_B rated higher in what they believed they had learnt compared to group G_A .

Log-Linear analysis was conducted on the performance-based questionnaire data. Table 2 shows the effect of group and question type on correctness of answers. The subject-knowledge questions used for quantitative analysis were divided into *medium*

and *hard*, with two thirds being of *medium* difficulty and one third being *hard*. Some variation can be seen between groups. However, group G_B did fare better than group G_A in their overall mark with group G_A producing a lower percentage of correct answers on the hard questions, suggesting that they did not gain as deep an understanding as group G_B.

Table 2: Percentage of correct answers across group and question type.

	% of Correct Answers		
	Medium	Hard	Total
Group G _A	33%	15%	27%
Group G _B	46%	25%	38%

Further analysis was used to determine the effect of derived T/L strategies on age group and gender. The results are represented in Tables 3 and 4.

Table 3: Percentage of correct answers across group and gender.

	% of Correct Answers	
	Male	Female
Group G _A	20%	35%
Group G _B	31%	46%

Table 4: Percentage of correct answers across group and age.

	% of Correct Answers		
	Under 30	30 to 40	Over 40
Group G _A	17.6%	21.2%	50.0%
Group G _B	30.9%	35.3%	51.0%

The results presented above indicate that, in general, the participants in group G_B had more correct answers than the participants in group G_A. To look at this in more detail, Table 3 shows a better result in females and Table 4 shows a better result in those Over 40 through both groups.

4.5 Focus groups

The final evaluation method used was a focus group discussion, one per group. These lasted approximately one hour each and consisted of a series of questions relating to difficulties, impressions and suggestions about the course. The questions used were open-ended and intended to encourage discussion.

4.5.1 Group G_A

In general there was a very positive response. The research participants found the exercises helpful, the notes clear and extensive, and navigation easy. Most enjoyed the self-paced style, but missed the presence of a tutor. They approached the course in both a linear and non-linear fashion. Overall, suggestions tended to concentrate on the

need for easier assess and contact with the tutor and other students. They were happy with what the course had to offer but wanted more guidance and communication.

4.5.2 Group G_B

In general, a positive and interesting response. Again the research participants found the course material easy to follow but missed having someone present to help explain things. They felt that the use of stated objectives, colour, quick quizzes and self-tests was a benefit. The quizzes and self-tests helped point out what sections of the lesson needed review. Participants approached the course in both linear and non-linear fashion. Although this group had the derived T/L strategies their suggestions focused on the inclusion of more T/L strategies. They would have liked to see brighter colours, a choice of colours and adjustable menu systems, allowing a choice of presentation style i.e. all at once or chunked. These participants were very inspired by the course, yet seemed to want more T/L strategies built into the program.

Discussion

During this research a prototype was produced and used to test and evaluate the enhancement of student attitude, perception and overall performance in regard to age and gender. Combining the findings of the literature review with current research into Web-based design resulted in the development of the new principles and guidelines used in this research. A set of T/L strategies was implemented using the developed principles and guidelines. The statistical analysis conducted on both qualitative and quantitative data indicated that the application of theory-based learning strategies had a positive effect on learner outcome and enhanced student perception and performance within a WBI program.

Further examination using Log-Linear analysis indicated that females over forty years of age tended to fare better than younger females. There are several issues here. Females do tend to perform better than males in both groups, and those participants over 40 appear to perform better in both groups. The results in Table 4 suggest that those over 40 were not affected by the addition of theory-based learning strategies. Perhaps, by the age of forty, they already have well established learning strategies of their own which they can apply to any given situation. This is an interesting outcome. Figure 3 shows the group/age results graphically. From this it can be seen that younger students tend to respond to the guidance provided by the derived T/L strategies. In both the under 30 and 30 to 40 range, the members of group G_B fared better than those in group G_A , but the over 40s had very similar results.

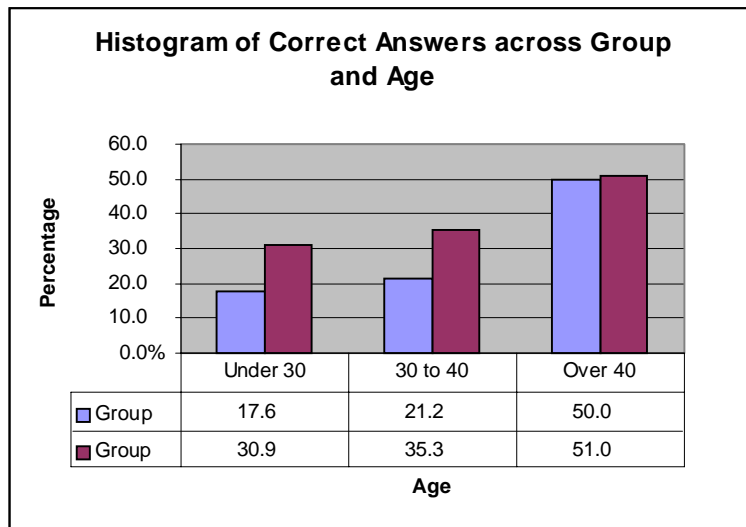


Figure 4: Correct answers across group and age

Conclusion

This research was inspired by the need for a deeper understanding about how people learn and how this knowledge may be incorporated into present-day educational technology. The emphasis is on the role of theory-based learning strategies in the production of WBI. Educational theories need to be interwoven with the interactive multimedia technology itself to provide a suitable environment for enhanced perception and performance of students.

Although the initial research aim of the overall project was to investigate the application of theory-based learning strategies with interactive multimedia for online course delivery, an important outcome in regard to age and gender was identified. The results suggest that females perform better than males with online course delivery regardless of applied T/L strategies, and that people over 40 appear to be unaffected by the addition of theory-based learning strategies. Further studies are required into why this effect has occurred. Motivation is perhaps a major issue to be considered. The participants were asked why they undertook the course, and “to produce a web page” was the foremost reason with an over 60% response.

What this research has shown is that the use of theory-based learning strategies in WBI can improve overall student performance and perception. It has shown that a relationship does exist between theory-based learning strategies, WBI and the age and gender of the end-user. The results established here suggest the need for further investigation into the effect of theory-based learning strategies in WBI with a particular focus on age, gender and motivation.

However, the problem of how this information can best be used when designing WBI remains to be resolved. Consideration must be given to the adaptability of WBI programs and the potential of such technologies as Intelligent Tutoring Systems (Rowe and Galvin, 1998) as a possible option. With the increasing use of the Internet for educational purposes by students of diverse and dissimilar backgrounds, the solutions of these research issues will reinforce the power of information and educational technology for the future.

References

- Bell, M. and Lefoe, G. (1998) Curriculum Design for Flexible Delivery – Massaging the Model, *Conference Proceedings ASCILITE'98*, Wollongong, Australia.
- Carswell, L. (1997) Teaching via the Internet: The impact of the Internet as a communication medium on Distance Learning Introductory Computing Students, *ITiCSE '97 Uppsala, Sweden*
- Dalgarno, B. (1998) Choosing learner activities for specific learning outcomes: A tool for constructivist computer assisted learning design. In C. McBeath and R. Atkinson (eds), *Planning for Progress, Partnership and Profit*. Proceedings EdTech'98. Perth: Australian Society for Educational Technology.
[<http://cleo.murdoch.edu.au/gen/aset/confs/edtech98/pubs/articles/abcd/dalgarno.html>]
- Eaton, M. (1996) Interactive features for HTML-based tutorials in distance learning programs, *Conference Proceedings AusWeb96*, Australia.
- Jones, V. and Jo, J. H. (1998) Interactive Multimedia based on Learning Theories to Enhance Tertiary Education, *Conference Proceedings ICCIMA '98*, Australia
- Jones, V. (1999) *An Educational Model using Interactive Multimedia and Learning Theories: An enhancement to computer and internet-based education*, Honours Dissertation, Griffith University, Gold Coast.
- Kent, P. (1995) *Computers - Constructionism - Constructivism: A brief reading study by Phillip Kent, November 1995*, [<http://metric.ma.ic.ac.uk/~pkent/construction/construction.html>] (August, 1999).
- McMahon, M. (1997) Social Constructivism and the World Wide Web – A Paradigm for Learning, *Proceedings of ASCILITE'97*, Perth, Australia.
- Montgomery, S. M. (1995) *Addressing diverse learning styles through the use of multimedia*, [<http://FrE.www.ecn.purdue.edu/FrE/asee/fie95/3a2/3a22/3a22.htm>] (22 June 1997)
- Ohlund, B. (1997) *Constructivism and CMC: The Importance of Constructivist Approach in Computer-Mediated Communication*, [<http://seamonkey.ed.asu.edu/~mcisaac/emc703old97/spring97/7/ohl7.htm>] (May, 1999)
- Pilgrim C. J., and Creek M. J. (1997) On-line Education - A University Strategy, *Proceedings of ASCILITE'97*, Perth, Australia. [<http://www.curtin.edu.au/conference/ASCILITE97/papers/Ring/Ring.html>]
- Ring, G., Jadav, A. and Pagram, J. (1997) Electronic Delivery of Interactive Multimedia Courses for Distance Education, *Proceedings of ASCILITE'97*, Perth, Australia. [<http://www.curtin.edu.au/conference/ASCILITE97/papers/Ring/Ring.html>]
- Rowe, N.C. and Galvin, T.P. (1998), An authoring system for intelligent procedural-skill tutors, *IEEE Intelligent Systems & Their Applications*, **13** (3).
- Updegrave, K. (1995) *Teaching on the Internet*, [<http://dolphin.upenn.edu/~kimu/teaching.htm>] (6 Nov. 1997)
- Wiersma, W. (1995) *Research Methods in Education: An Introduction*, 6th Ed., Allyn and bacon, U.S.A.
- Wild, M. and Omari, A. (1996) A working model for designing learning environments, *Conference Proceedings AusWeb96*, Australia.

© Jones, V. and Jo, J.H.

The author(s) assign to ASCILITE and educational non-profit institutions a non-exclusive license to use this document for personal use and in course of instruction provided that the article is used in full and this copyright statement is reproduced.

The author(s) also grant a non-exclusive license to ASCILITE to publish this document in full on the World Wide Web (prime sites and mirrors) and in printed form within the ASCILITE99 Conference Proceedings. Any other usage is prohibited without the express permission of the author(s).