

## ICT-Pedagogy Integration in Teacher Training: Application Cases Worldwide

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### ABSTRACT

Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and modern technologies are demanding teachers to learn how to use these technologies in their teaching. While new technologies increase teachers' training needs, they also offer part of the solution. Information and communication technology (ICT) can provide more flexible and effective ways for professional development for teachers, improve pre- and in-service teacher training, and connect teachers to the global teacher community. This paper analyses and organizes a variety of approaches found in ICT uses in teacher training into a four-cell matrix. Based on the analysis of those approaches, it discusses new possibilities and challenges that ICT has brought to teacher training and professional development. It concludes with discussion of emerging research issues with respect to ICT integration into teacher training and networking.

### Keywords

ICT teacher training, ICT use, online training, teacher training, training approaches

### Introduction

While information and communication technology (ICT) is not a panacea for all educational problems, today's technologies are essential tools for teaching and learning. To use these tools effectively and efficiently, teachers need visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment. Only then can teachers be informed and confident in their use of new technologies (Bowes, 2003).

Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and much of it is available to students as well as teachers at the same time (Perraton, Robinson, & Creed, 2001). As new concepts of learning have evolved, teachers are expected to facilitate learning and make it meaningful to individual learners rather than just to provide knowledge and skills. Modern developments of innovative technologies have provided new possibilities to teaching professions, but at the same time have placed more demands on teachers to learn how to use these new technologies in their teaching (Robinson & Latchem, 2003). These challenges ask teachers to continuously retrain themselves and acquire new knowledge and skills while maintaining their jobs (Carlson & Gadio, 2002). Then what can be done to help teachers meet these challenges?

Today, a variety of ICT can facilitate not only delivery of instruction, but also learning process itself. Moreover, ICT can promote international collaboration and networking in education and professional development. There's a range of ICT options – from videoconferencing through multimedia delivery to web sites - which can be used to meet the challenges teachers face today. In fact, there has been increasing evidence that ICT may be able to provide more flexible and effective ways for lifelong professional development for today's teachers.

Because of rapid development in ICT, especially the Internet, traditional initial teacher training as well as in-service continued training institutions worldwide are undergoing a rapid change in the structure and content of their training and delivery methods of their courses. However, combining new technologies with effective pedagogy has become a daunting task for both initial teacher training and in-service training institutions.

This paper looks at a variety of approaches in ICT-Pedagogy integration in teacher training. Those approaches are organized into a four-cell matrix and elaborated with the collection of cases in an international context. Via a variety of examples, the author tries to show that ICT use is not only a matter of new possibilities but that it also brings with it new implications and new challenges. The paper concludes with a discussion of emerging research

issues involved in ICT applications in teacher training. Methods employed in this study include desk analyses of various ICT teacher training cases and approaches published in selected articles or websites and face-to-face or email interviews with experts for verification.

## Teacher Training Approaches

Research indicates that ICT can change the way teachers teach and that it is especially useful in supporting more student-centered approaches to instruction and in developing the higher order skills and promoting collaborative activities (Haddad, 2003). Recognizing the importance of ICT in teaching and learning, a majority of the countries in the world have provided ICT teacher training in a variety of forms and degrees. Even though many teachers report that they have not had adequate training to prepare themselves to use technology effectively in teaching and learning, there seem to be several efforts around the world in which countries are effectively using technology to train teachers, and/or are training teachers to use technology as tools for enhancing teaching and learning.

ICT teacher training can take many forms. Teachers can be trained to learn HOW to use ICT or teachers can be trained VIA ICT. ICT can be used as a core or a complementary means to the teacher training process (Collis & Jung, 2003). This paper organizes various ICT teacher training efforts found in different countries into four categories using the framework of Figure 1.

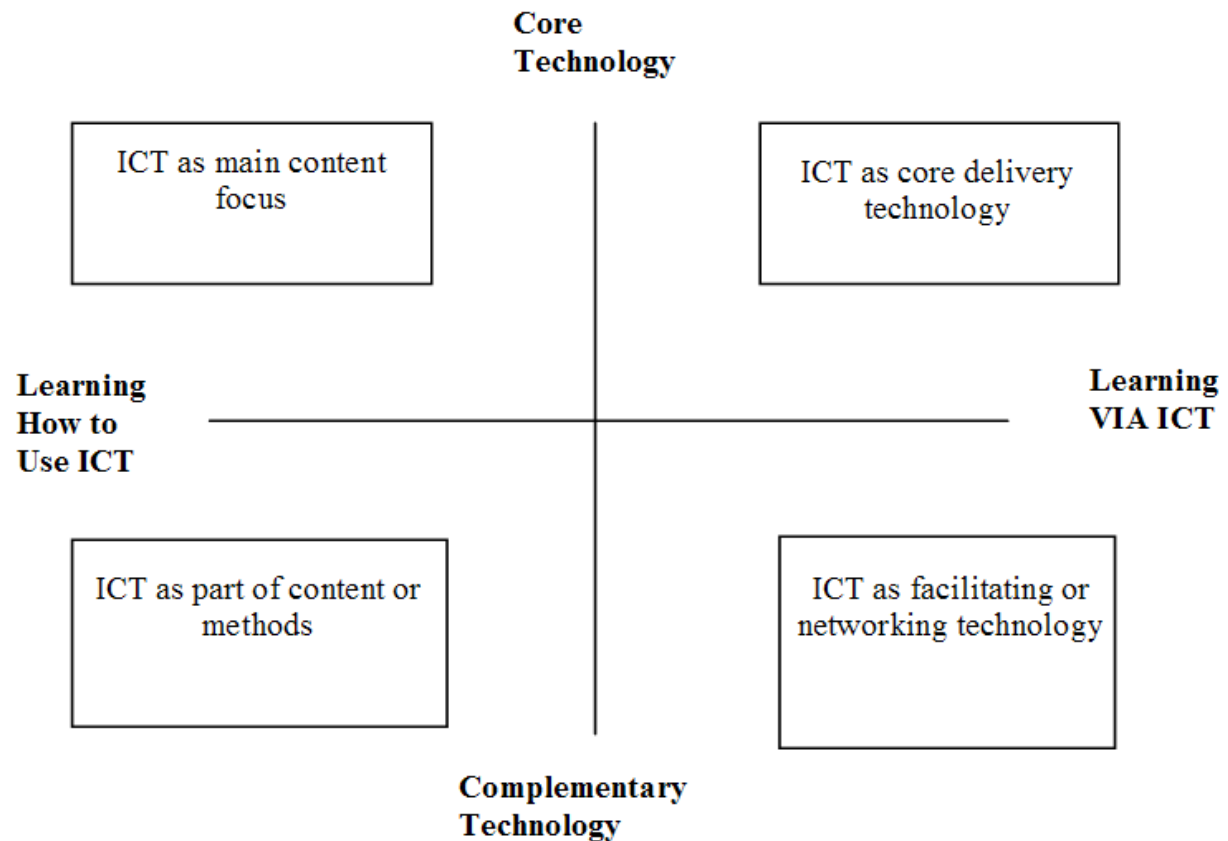


Figure 1. Categories for ICT in teacher training (adapted from Collis & Jung, 2003, p.176)

### ICT use as main content focus of teacher training

Most of the early ICT teacher training programs in the 1990's focused on ICT use as the main training content. This approach has an emphasis on teacher training in how to use ICT in the classroom. It addresses issues such as selecting appropriate ICT tools and supporting students in the use of those tools, using ICT to promote learning activities, developing new methods of facilitating learning and evaluating student performance, and so on. One example case from Singapore's initial teacher training is provided below.

As Singapore's only pre-service teacher training institute, the National Institute of Education (NIE) was entrusted with the responsibility for integrating ICT into initial teacher training programs based on the nation's Masterplan for IT in Education. Accordingly, the NIE developed and began implementing a new ICT plan in 1998, which identified four main areas that needed change: curriculum; physical and technological infrastructure; human resource infrastructure; and R & D in the use of ICT in education. For the purpose of this chapter, I will focus on how NIE has revised its curriculum to promote ICT use in the classroom for future teachers (Jung, 2001).

The curriculum was revised to include three kinds of ICT courses for student teachers: basic ICT-skill workshops, a 30-hour ICT foundation course, and a 26-hour elective course. In addition, the 6 to 12 hours of ICT integration into each curricular subject class was recommended. Basic ICT skill workshops, paid for by students, are provided by external organizations and cover word processing, PowerPoint, Internet literacy, and other technical skills. A 26-hour elective course covers the design and production of computer-based instruction. A 30-hour ICT foundation course is entitled "Instructional Technology" and covers: "learning, thinking and the effective use of instructional technologies in the classroom; instructional planning models; selecting, creating, evaluating, and integrating instructional technologies and resource materials; promoting creativity and complex thinking through ICT project work activities; and organizing and managing instructional activities with appropriate ICT resources in the classroom." Besides taking these courses, NIE students pursuing a Diploma in Education must have five weeks of practicum during the first year of their pre-service training and ten weeks during the second year. The trainee is expected to use ICT while teaching, depending on the school's ICT infrastructure.

As shown in the NIE's case, this approach of using ICT as the main content focus of teacher training emphasizes the development of basic ICT skills, design and development skills, and pedagogical strategies. However, the basic ICT skill development, rather than the ICT-pedagogical integration, has been the major concern of teacher training. When interviewed about the new teacher training curriculum, student teachers at NIE agreed that the foundation course provided useful pedagogical strategies for the use of ICT in classroom teaching. However, they also reported that the 30 hours of instruction was not enough time to gain proficiency in ICT-pedagogy integration, and some wanted more ICT-pedagogy integration in the practicum. The next approach provides a more effective way of ICT-pedagogy integration in teacher training programs.

## **ICT use as part of teaching methods**

This approach integrates ICT into teacher training to facilitate some aspects of training. Two cases below show how a variety of ICT are adopted as part of effective training methods. In these cases, teachers are provided with examples of ICT-pedagogy integration in their training process.

Captured Wisdom (<http://www.ncrel.org/cw/>) is a resource developed by the federally-funded (USA) North Central Technology in Education Consortium for K-12 teachers, school administrators and extended to adult literacy educators. It uses videotape and CD-ROM to help US teachers to see how technology can be integrated into their work. The Captured Wisdom (tm) CD-ROM Library is made up of stories about teachers who are making meaningful and creative uses of technology in their instruction. These CD-ROMs contain video descriptions and demonstrations of how technology is used in teachers' classrooms. They provide "examples of real educators and learners using successful practices of technology to support instruction and learning in their classrooms." Video sequences are viewed by teachers' focus groups who then discuss the strategies and techniques of classroom management, assessment, etc. In this specific case, teachers learn how to use ICT in their classrooms by actually being engaged in the process of ICT-integrated training.

Another example of this approach can be found in the School Administrators' Technology Integration Resource (<http://www.satir-ritas.org>) project. It is a bilingual Canadian initiative which provides tools and resources to help school administrators successfully integrate ICT into curriculum in their school. It includes the National Center for Technology Planning clearinghouse of school district ICT plans, advice on how to provide technology, successful practices in introducing ICT, perspectives on staff development, a beginners' guide to the Internet, etc. The focus of this project is not on the basic skill development but on the development of ICT-pedagogy integration skills of educators by sharing successful cases and practical ideas.

UNICEF's Teachers Talking About Learning (<http://www.unicef.org/teachers/>) also illustrates the application of this approach to ICT teacher training. It is designed for international collaboration between teachers in

developing countries using the Internet and television. It provides access to teacher training materials and useful links and promotes discussions among teachers.

All the cases discussed above use ICT as part of training methods and promote teachers' ICT-pedagogy integration in the classroom by demonstrating examples and allowing discussions among teachers throughout the whole training process. Participants of the training are asked to actually use ICT to learn about ICT skills and develop ICT-integrated pedagogies. These training strategies seem to be supported by previous research that argues that teachers are likely to benefit by actively experiencing ICT skills as a learner (Jung, 2003).

## **ICT as core technology for delivering teacher training**

In this approach, ICT is used as the major way of providing the learning experience of teacher training. The content of this approach does not necessarily focus on ICT skill itself but rather covers a variety of ICT applications. As you will see in the two examples below, the digital technology is frequently becoming the core technology of ICT teacher training.

The case of the Virtual High School (VHS: <http://www.govhs.org/website.nsf>) in the USA provides an example of the Internet-based ICT teacher training. VHS is a non-profit organization that facilitates a collaborative of participating secondary schools; for every semester a participating school offers a VHS NetCourse that school can enroll up to 20 students in VHS courses. A limited number of student-only schools are allowed to enroll students (10 per semester) on a trial basis, for a single year, after which they must train a teacher and join VHS as a fully participating school. The VHS has developed two graduate-level online professional development courses for teachers of participating high schools: a 26-week Teachers Learning Conference (TLC) course which trains teachers to develop and teach a NetCourse for VHS and a 15-week Netcourse Instructional Methodologies (NIM) which trains teachers to teach an existing online VHS course.

The TLC is designed to train teachers to become online course instructors and course developers whereas the NIM is designed to prepare classroom teachers to become online course instructors only. The TLC provides instruction on the pedagogy and methodology that each teacher will need to develop an effective NetCourse to be offered to the VHS students. A facilitator, a veteran VHS teacher, is assigned to each TLC participant to ensure that they have the correct resources to achieve training objectives. The focus the NIM is on content and curriculum, as well as good online course delivery. Experienced facilitators are assigned to help NIM participants access the correct resources and monitor each participant's progress.

Both of the teacher training courses at VHS use the Internet as the main delivery technology and focus on ICT-pedagogy integration in an online learning environment. Support given by facilitators of these courses is known as an important factor which helps teachers have positive experiences with technology and integrate technology into their own teaching (Freeman, 1997).

Another case of adopting ICT as the core delivery means of teacher training can be found in the LearnLink project (<http://www.aed.org/learnlink>) supported by USAID and AED. The project has implemented computer-mediated professional development programs to improve training and support services for teachers in several developing countries (Fontaine, 2000; Collis & Jung, 2003). For example, in Guatemala, the project includes the development of culturally appropriate Mayan language instructional materials, and improvement of teacher's professional skills in Mayan languages. Necessary equipment and multimedia computer labs have been installed in several teacher training schools in the Quiche region and instructional materials for bilingual teacher preparation, including an interactive multimedia system on CD-ROM to train teachers in oral and written languages have been developed. In Morocco and Namibia, the Computer Assisted Teacher Training project has started to develop computer-assisted teacher training courses and construct communications network to facilitate interaction among teacher trainees, teacher trainers, and inspectors. Moreover, collaboration and information sharing among peers across the provinces have been emphasized. Similarly, the Connectivity for Educator Development project in Uganda has been designed to improve professional development for primary school teachers, with a focus on multimedia-assisted teacher training and digital library resources. The US-Brazil Learning Technologies Network is an Internet-based learning environment and clearinghouse on the role of ICT in education and promoting interactive collaboration between teachers in the two countries.

The LearnLink project is still under implementation. Some of the expected outcomes include: increased collaboration and interactions among educators in each country or among countries, institutionalization of

support for learning technology in each country, greater ICT access for teachers and students, ICT-based curriculum reform, and enhancement of pedagogy.

An Internet-based online teacher training is recently introduced and has been found to provide a flexible and interactive training environment for teachers (Jung, 2003). However, costs related to the online training cannot be ignored in most parts of the world and effective online training pedagogies for ICT teacher training have yet to be explored.

## **ICT used to facilitate professional development and networking**

Whereas the use of ICT as core technology for delivering teacher training can be found in limited contexts, there are many examples of ICT, particularly Internet and Web-based communication technologies, being used to support teachers' on-going professional development and networking. Many countries have developed a website or websites to provide online resources for teachers and facilitate teachers' networking based on the assumption that professional development should be an integral part of daily practice for all teachers and the use of the Internet would enhance continuous professional development activities of teachers, connecting teachers to larger teaching communities and allowing for interaction with expert groups. Specific examples are discussed below.

The UK Virtual Teacher Centre (<http://vtc.ngfl.gov.uk>) website provides a "Career Development" area which provides a variety of learning and teaching resources and links to support teachers' continuing professional development. Under "Support Providers", for example, teachers can find a range of resources for professional development, such as the ICT Support Network Directory which provides easy access to ICT provision and training. Teachers also find a link to the New Opportunities Fund (NOF), which is currently providing ICT training for teachers and librarians. "International Professional Development" helps teachers learn from and contribute to educational ideas and best practice throughout the world. TeacherNet UK (<http://www.teachernetuk.org.uk>), an independent professional association for teachers, also supports teachers' professional development and national and international teacher networking.

The Korea's EduNet (<http://www.edunet4u.net/>) is an integrated educational internet services for K-12 students and teachers managed by the Korea Education and Research Information Services. Through the EduNet, teachers can search the materials according to training institution, content, instructor, year of publication and type of training, and download them for self-training. These online materials can be also used for individual study in conjunction with face-to-face courses, or as learning resources for online teacher training courses offered by educational institutions.

Similar to the cases above, the US Teachers Network (<http://www.teachnet.org>), a nationwide, educational non-profit organization, identifies and connects innovative teachers exemplifying professionalism and creativity within public school systems. This network promotes interactive collaboration among teachers and educators to improve teaching and student achievement, provides resources for designing their own professional development, disseminates the work of outstanding classroom teachers, and attempts to provide teachers with the knowledge and skills needed for good teachers. At the international level, the World Bank's World Links for Development (WorLD) (<http://www.worldbank.org/worldlinks/english/index.html>) program provides Internet connectivity and training for teachers, teacher trainers and students in developing countries in the use of ICT and other technologies in education. WorLD then links students and teachers in secondary schools in developing countries with schools in industrialized countries for collaborative learning via the Internet.

Other examples include: SchoolNet SA (<http://www.school.za>), a South African organization providing supports to educators and learners who wish to use ICT in education; Singapore' Clearinghouse (<http://www1.moe.edu.sg/iteducation/resources/welcome.htm>), a website created by Ministry of Education to provide ICT resources and internet educational resources including lesson plans for various content areas for teachers; Swedish Schoolnet (<http://www.skolutveckling.se/skolnet/english/index.html>), a website to stimulate the use of ICT in schools; and European Schoolnet (<http://www.eun.org/eun.org2/eun/en/index.html>), the European framework for the co-operation between the European Ministries of Education on ICT use in education.

One of the best ways to develop teachers' ICT skills and promote ICT-pedagogy integration in their teaching is the provision of ICT-based training environments where on-demand access to materials, peers, and networks of experts where expertise and advices can be obtained and active discussion can take place in relation to

technology or pedagogy. In this regard, the approach of using ICT to support teachers' on-going professional development and networking can be very effective as long as organized support is provided (Pacey, 1999).

## Discussions and Conclusions

This analysis of approaches in ICT teacher training indicates that there are possibilities and challenges in adopting ICT in teacher training and professional development. Some possibilities are discussed below.

Overall, governments and teacher training institutions seem to recognize the importance of integrating ICT in education and teacher training. In many cases, the national vision for ICT use in education has been integrated into teacher training. For example, Singapore's teacher training institute has successfully integrated the national vision toward ICT use in education into its ICT plan. Other countries such as UK, USA, South Africa, Sweden and Korea have developed extensive online resources and encouraged active exchanges of new pedagogical ideas to upgrade teachers' knowledge and skills at the national or international level. In addition, the LearnLink project in several developing countries is being implemented with close relationship with each country's government to integrate its activities into the nation's educational vision and policies.

It is also observed in the analysis that a variety of ICT-integrated training environments have been created to provide more effective ICT training. As indicated above, teachers tend to integrate ICT in their teaching if they experience ICT skills as a learner (Collis & Jung, 2003). Teacher training approaches in this paper show that many cases adopt ICT into their training process not just as content of the training but rather as an integrated training environment and thus allow teachers to experience ICT-based pedagogies. The cases of VHS and Captured Wisdom are those examples. One UK site has compiled cases of technology-integrated pedagogical strategies for teachers (<http://www.educ.cam.ac.uk/tips/reports.html>) and made suggestions in incorporating ICT into the curricula. More hands-on experiences that relate ICT to the achievement of wider pedagogical objectives are suggested at the initial training level and at the advanced level, the provision of opportunities for teachers to produce and disseminate ICT-based instructional materials is recommended.

Another possibility with the use of ICT in teacher training is that it connects teachers to a larger international teaching community. Several cases analyzed above operate the Internet-based teachers' learning community and support teachers to interact with peer teachers as well as teachers in other countries. Moreover, they invite experts to provide expertise to teachers through online forums or emails. Best practices in using ICT in teaching and learning and successful pedagogies are now being shared among teachers scattered around the world.

While these possibilities are observed in ICT teacher training approaches, those experiences also impose challenges to teachers, teacher training institutions, and nations. Some of the challenges are presented below.

First, teacher training approaches need to adopt cost-effective strategies. Most nations have limited resources for teacher training and must make decisions based on cost-effectiveness. The teacher training experiences provide several cost-saving strategies (Collis and Jung, 2003):

- Maximize use of computer facilities in training centers to lower user contact hour costs through efficient scheduling. Outside training hours, open computer labs to the public for a small fee (as Uganda has planned in the Connect-ED project).
- Standardize on hardware and software and negotiate best prices with vendors. Complementary peripheral devices can mean savings in hardware costs and free, public-domain software lowers costs. Some vendors include ICT skills training in the purchase price.
- Share Web-based resources and training materials with other training institutions.

Second, support and investment in teacher trainer training is important for the adoption of ICT for teacher training. The experiences of NIE, VHS, and LearnLink indicate the importance of providing a variety of both formal and informal teacher trainer training systems so that trainers could take advantage of the methods which suit them best. Experience shows that to enlist staff support and involvement, it is useful to:

- Employ a variety of teacher trainer training methods, ranging from face-to-face workshops to online self-study programs depending on training objectives and environments.
- Integrate informal support into the formal teacher trainer training system so that the less experienced teacher trainers can obtain timely assistance.
- Plan to provide multiple incentives such as workload reduction, recognition and reward in faculty evaluations, increased research allocations to encourage use of ICT in teaching, and compensation for those providing educational or technological assistance to others.

Finally, national and international partnerships across public and private sectors need to be formed to share resources, knowledge, and experiences in providing effective and efficient ICT teacher training. ICT teacher training efforts made by organizations have shown training advantages of international collaborations and benefits of using ICT for teacher training. One of such advantages of international collaboration is to bridge the gap between ICT haves and have-nots. Governments or teacher training institutions seeking to promote national and international partnerships should:

- Provide incentives for private and public participation and investment in ICT teacher training.
- Remove legal barriers – for example, classroom attendance requirement – to online training courses shared by several countries or institutions.
- Incorporate a plan to lessen the digital divide that may exist in participating countries or training institutions.

A well-designed teacher training program is essential to meet the demand of today's teachers who want to learn how to use ICT effectively for their teaching. This paper was an attempt to report popular approaches of using ICT in teacher training programs and organized them into four categories. However, to provide proven strategies to design effective ICT teacher training programs, we need empirical research in the use of ICT for teacher training and professional development.

First, we need more studies comparing effectiveness and cost-effectiveness of different training approaches. A few attempts have been made to investigate effectiveness or cost-effectiveness of online ICT teacher training over traditional face-to-face ICT training based on empirical data (Jung & Rha, 2000; Jung, 2003). One of those studies reports that ICT training, regardless the modes of the training, has contributed to increasing the quantity of ICT use in teaching and the Internet-based online training tends to encourage teachers' Internet use in teaching (Jung, 2003). While these studies are useful in providing overall effectiveness or cost-effectiveness of different training modes, not much research has been conducted to assess effectiveness or cost-effectiveness of specific pedagogical approaches to ICT teacher training which have been discussed in this paper. We need future studies that include the investigation of an application level of long-term effectiveness or cost-effectiveness of different ICT teacher training approaches using more elaborated criteria.

We also need more empirical studies focusing on factors affecting learning process, satisfaction and achievement in different teacher training approaches. Given the fast development of ICT, we can expect that ICT will bring changes in forms of teacher training throughout the world. It is thus important for teacher trainers and policy makers to understand the factors affecting effectiveness and cost-effectiveness of different approaches to ICT use in teacher training so training strategies can be appropriately explored to make such changes viable to all.

Finally, more attention should be paid to specific roles of ICT in offering multimedia simulations of good teaching practices, delivering individualized training courses, helping overcome teachers' isolation, connecting individual teachers to a larger teaching community on a continuous basis, and promoting teacher-to-teacher collaboration. Intended outcomes as well as unintended results of using ICT for teacher professional development need to be explored.

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