

# Infusion of Information and Communication Technologies into a Science Programme for Assistant Lecturers

Mziwoxolo Mayedwa, Tasneem Talip, Juliet Stoltenkamp

Centre for Innovative Educational and Communication Technologies (CIECT)  
University of the Western Cape  
Bellville, South Africa

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**ABSTRACT**— *The rapid growth and impact of Information and Communication Technologies (ICTs) has infiltrated almost every aspect of our lives across the globe. Hence, it makes sense that the Higher Education Institutions (HEI) should not be left behind in this phenomenon. The authors address how teaching-and-learning practices within HE settings can be enhanced through the effective infusion of ICTs. The Centre for Innovative Educational and Communication Technologies (CIECT) recently collaborated with the Science Faculty and other stakeholders at the University of the Western Cape (UWC), to design and develop a Programme, namely: Faculty of Science Teaching Assistants Development Programme (FSTADP). The paper highlights that the infusion of ICT into the curriculum depends on dedicated training and support interventions - in order for lecturers to successfully engage in the discourse related to the infusion of ICTs, and the actual implementation thereof. Therefore, “integrated institutional ICT infrastructure and systems with dedicated front-end and back-end support capacity and processes enable the development of pedagogically sound, interactive online courses which can be accessed at any time and from any geographical space”. Whilst ICT plays a critical role in enabling teaching-and-learning practices, it is imperative that the lecturer-student relationship be maintained.*

**Keywords**— ICT Infusion, ePedagogy, modes of delivery, blended learning, training and development.

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## 1. INTRODUCTION

Higher Education Institutions (HEIs) are faced with an increased need for ICT skills to support academics in their use of eLearning (Cross and Adam 2007; OECD 2012). Furthermore there is a need for ePedagogy training and support in a growing eLearning environment and carefully follow a viable instructional design process which will ensure adherence to a pedagogically sound teaching-and-learning methodology (Stoltenkamp, 2007). UNESCO (2002) proposes that an infusion approach should involve the integration or embedding of ICT across the curriculum. This should entail the application of a range of computer-based technologies in laboratories, classrooms and administrative offices in order to increase productivity and professional practice among lecturers. The Centre for Innovative Educational and Communication Technologies (CIECT), at the University of the Western Cape, has promoted the use of ICTs for teaching-and-learning practices since its inception in 2005. The team has maintained that the infusion of ICTs within the educational setting enhances teaching-and-learning through “offering the learner a genuine choice of learning routes, methods...and opportunities to interact meaningfully with content” (Dick, Carey and Carey 2001). Moreover, it has the “potential to bridge the knowledge gap” (Asian Development Bank 2009). Hence the paper reflects on how ICTs can be harnessed in order to identify these knowledge gaps, further enabling lecturer-student relations.

CIECT is a structure that provides the implementation of integrated, holistic support and development for the institution (Stoltenkamp et al. 2007). The Centre continuously promotes the integration of the effective use of educational technologies by developing training programmes that would empower the educators to take control and ownership of their eLearning initiatives (Stoltenkamp et al. 2007: 146). Hence the use of eTools at UWC among academics to enhance their teaching-and-learning practices has shown an enormous growth across all Faculties.

This paper addresses how CIECT in collaboration with the Science Faculty and other stakeholders (Library, Writing Centre), designed and developed a programme for lecturer assistants, namely: Faculty of Science Teaching Assistants Development Programme (FSTADP). "This programme was designed to prepare future Science lecturers at the University of the Western Cape (UWC) and focuses on the teaching roles of the academic in Science Higher Education, with reference to learning-centred teaching strategies embedded in a constantly changing practice" (Dr. Rita Kizito<sup>1</sup>).

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<sup>1</sup> Dr Rita Kizito is a Science Faculty teaching-and-learning specialist and also a Project Coordinator of FSTADP

## **2. LITERATURE REVIEW**

### ***2.1. Infusion of ICTs in higher education***

Studies have indicated that there is an increased need for infusing ICTs into the curriculum within the HEI setting (Bransford et al. 2000; Wong et al. 2006; Shemla and Nachmias 2006; and Grabe and Grabe 2007). Infusing new technologies has the potential to transform the way teaching-and-learning is carried out by having an effectively supported curriculum and improved interaction between lecturer and student (Dawes 2001). The use of ICTs can facilitate better learning, as it allows instructors to integrate a number of technologies to develop innovative approaches to teaching-and-learning (Condie et al. 2007).

In addition, ICTs also have “the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate learning experiences to work practices” (Davis and Tearle 1999). Furthermore, ICTs can promote learning through more relevant learning opportunities; enabling student interactivity; and increasing flexibility of delivery and access (Miller et al. 2000).

Subsequently, universities around the world are showing an increased interest in how ICTs can add pedagogical value to teaching-and-learning practices (Palaiologou 2008). However, it is important to assess the impact of using multiple technologies in the service of learning (Clayton-Pedersen and O'Neill 2005). Therefore it is imperative that the infusion of ICTs into a curriculum should “integrate the potential benefits of technology without losing the pedagogical nature of learning” (Lytras et al. 2000; Stockwell 2007).

### ***2.2. Creation of blended learning programmes***

Garrison and Kanuka (2004) stated that blended learning is the thoughtful integration of face-to-face learning experiences with online learning experiences. It is further defined as ‘hybrid’ learning, enabling the seamless integration of both online and face-to-face learning (Collis and Moonen 2001).

In adopting a blended learning approach one has to “inherently rethink and redesign the teaching and learning relationship” (Garrison and Kanuka, 2004). It would therefore require revising a current instructional delivery method to incorporate other teaching-and-learning methodologies, which encourages student interactivity; and moreover engagement with course material (Kenney and Newcombe 2011). Revised teaching methodologies could entail, “the advent of new learning technologies, such as podcasting and vodcasting, internet based audio and video communication, e-portfolios and social networking tools including blogs and wikis create new blending potentials” (Stacey and Gerbic 2008). However, the goal of a blended approach is to attain an appropriate balance between face-to-face and online instruction for the students’ benefit. Hence, the instructor is able to engage students, clarify concepts, and further encourage them to interact with one another in face-to-face or team problem-solving (Rothrauff 2011). Lorenzetti (2011) further emphasises that blended learning does not only introduce online learning, it also gives access to new resources; it helps to meet student expectations and allow for more flexibility and convenience.

This research therefore highlights the creation of a blended learning Programme, which required more than technical solutions, such as a Learning Management System (LMS). It required the infusion of ICTs into the design of the holistic lecturer assistant Programme. Furthermore, it included discussions with stakeholders related to the various modes of delivery; target audience; assessments; and adequate training and support for the lecturers.

### ***2.3. Programme delivery: Various modes***

It is without doubt that eLearning has played a pivotal role in delivering instructional content by supplementing face-to-face with online delivery and improving interaction between lecturers and students (Fadzil and Latif 2005). As much as eLearning has this important role, there has also been a greater focus on placing the content online, using different technologies (Gibbs and Gosper 2006).

Therefore it is also vital to explore the role of mobile technology (mLearning) as a mode of delivery within HEIs to further accelerate the adoption of eLearning (Valk et al. 2010). “Mobile learning is learning by means of wireless technological devices that can be pocketed and utilised wherever the learner’s device is able to receive unbroken transmission signals” (Attewell and Savill-Smith 2005). More than 93% of South Africans have access to mobile phones while 90% are owners of mobile phones<sup>2</sup>. This high penetration of mobile devices would assist instructors in the development of instructional content and enhance just-in time electronic interaction with the students (Valk et al 2010).

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<sup>2</sup>Infographic: Cell Phone Usage and South Africa Stats <http://www.chrisrawlinson.com/2011/02/infographic-cellphone-usage-sa-mobile-stats/>

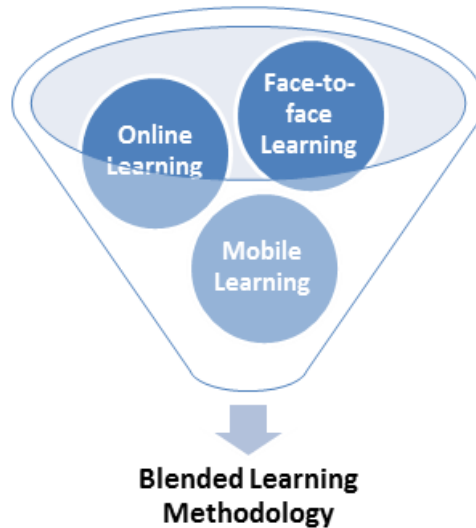


Fig 1: Blended Learning Methodology - Adapted from 24x7 LEARNING (undated)

In the context of this study, mLearning refers to the use of mobile technologies to deliver and access online teaching-and-learning practices. During training interventions, mobile devices, such as, iPads and tablets acted as content carriers; and especially to interact with eTools for teaching-and-learning purposes.

It is important to note that mLearning does not replace eLearning, rather it increases access, and adoption of online learning through the use of mobile technologies (Haag 2011). A computer can be shared among different users, but mobile devices are designed to be used by a single user. This means that personalised information can reach the same user at any time through one specific device (Kushchu and Borucki 2004). Hence, this case study highlights the importance of the use of mobile technologies, considering benefits, namely: accessibility; innovative tools; and adoption rates.

### 3. RESEARCH METHODOLOGY

The study adopted a case study approach. The study reported on a three (3) day training workshop conducted by the CIECT team focusing on ICT infusion for future science lecturers in the Faculty of Science at UWC. The training programme focused on ‘*designing an online instructional event*’ with the following key focus areas:

- Day 1: Create an online portfolio,
- Day 2: Create an interactive online course, and
- Day 3: Make use of mobile integration devices.

The researcher collected data by distributing three questionnaires related to the structure of the programme above (Day 1- 3). Table 1 below reflects common questions posed to the Science lecturers. A total number of 48 questionnaires were anonymously completed by participants.

**Table 1:** Common research questions related to the 3 questionnaires

To what extent were your expectations and needs met?	To what extent were the topics relevant and appropriate to your needs?	To what extent was the content covered sufficient in this training?	To what extent did the training add value to your understanding of the topics covered?	To what extent will you be able to apply the training in the workplace?
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It should also be noted that prior to the three day (3) workshop, documents related to the infusion of eTools to enhance the instructional practices of the lecturers, were shared with the instructional designer and the FSTADP coordinator via various platforms (refer to Table 2).

**Table 2:** List of materials used

Materials Used	Media	Explanation
Meeting Minutes	Electronic	Teaching-and-learning specialist, Programme coordinator, Instructional designer and CIECT Director
Transcripts	Paper	Research question completed by the participants
Dairies	Paper	Training reflection from participants
Emails	Electronic document	Meeting Agendas Discussions/comments exchanged among researchers Documents forwarded among researchers and programme coordinators
Website	Electronic	Electronic documentation shared

Furthermore, 48 questionnaires were analysed, transcribed and interpreted. The results are discussed in the following section.

#### 4. DISCUSSION: RESEARCH RESULTS

The paper highlights that the infusion of ICT into the curriculum depends on dedicated training and support interventions - in order for lecturers to successfully engage in the discourse related to the infusion of ICTs, and the actual implementation thereof. The research results have “demonstrated firm and visible evidence” (Ely 1999), as the dedicated training and support interventions played a critical role to successfully infuse ICTs in the programme.

The training addresses both skills development and pedagogical issues (Cooley and Johnston 2000); and it prepares lecturer assistants for the workplace. The training intervention has a positive effect on employment (Bassols 2002), as it increases productivity and competitiveness by acquiring new knowledge and skills (Mariscal et al. 2008; Konings 2008). In addition, training alone is not always sufficient unless it is underpinned by “supportive environments” (Aguinis and Kraiger 2009); and such support (pedagogical, administrative and technical) should be readily available (Green 2000).

Below is the reflection on the support and training processes delivered by CIECT throughout the ICT sessions of the Science Programme.

##### 4.1. Reflection: Support Processes for the Programme

In preparation for the FSTADP workshop, an Instructional Designer of the CIECT support team met with the Teaching and Learning Specialist with regard to the design of a blog space. This blog space was designed to provide an environment where lecturer assistants could participate in tasks and engage with facilitators around related issues.

The creation of this blog space entailed four intensive support steps conducted by the Instructional Designer:

*Step 1:* The Instructional Designer (ID) designed the blog space according to the needs of the Faculty, as specified by the Programme Coordinator. It should be noted that the Instructional Designer had to conduct research related to design and structure before embarking on the creation of the blog. In addition, these processes expected that the ID apply some ‘coding skills’ in order to meet the coordinator’s structural requirements.

*Step 2:* During this step the ID had to add the facilitators’ and the lecturer assistants’ blog sites; as well as content (general information related to the Programme and facilitators). This step entailed extremely tedious processes for the ID, as the students were expected to forward their specific blog addresses (url’s) to the ID in order for it to be displayed within the overall FSTADP site. However, many of the lecturer assistants were not able to create their blog sites despite the fact that the coordinator had arranged prior training for this group from another source. Subsequently, this led to personal support by the ID for these lecturer assistants: office consultations, telephone and email support.

*Step 3:* During this step, facilitators from the other stakeholder groups (Library and Writing Centre) were also assisted with adding their content into their specific online workshop spaces. It should be noted that these facilitators needed extensive support, with regard to creating links to specific files/content. The ID had to provide detailed instructions to this group via email and telephone. Hence, the ID provided the user with incremental steps/instructions telephonically.

*Step 4:* During step 4 (integrated with other support steps) – the ID placed instructional material within the CIECT workshop blog space, related to the completion of tasks for the Programme, specifically the eTools training sessions. In addition, the participants regularly received email reminders related to the completion of tasks. The researchers were able

to reflect on these intensive support steps, which indicated that there was a dire need for face-to-face, ongoing support for the coordinator, facilitators and students (lecturer assistants) of this Programme. Hence, the infusion of ICT into a specific Programme requires a dedicated support team with appropriate skills to assist with design, development, facilitation and online support.

Figure 2 below, reflects on the structure and layout of the various activities within the created blog space. The Programme coordinator depended on the Instructional Designer to create this interactive blog space.

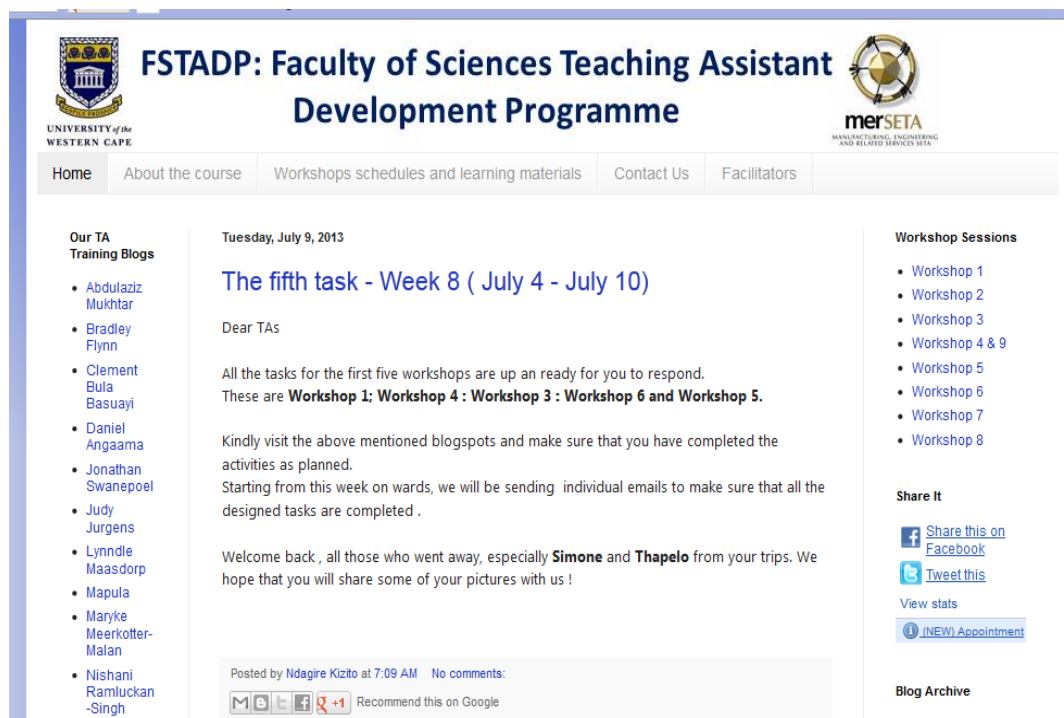


Figure 2: FSTADP Blog Space

#### 4.2 Reflection: Training Sessions for the Programme

The following sections further reflect on the findings related to the completed questionnaires and seek to examine the pedagogical value of the three training sessions: the creation of an ePortfolio; an interactive online course and the use of mobile devices. The collected data was documented and analysed using the IBM SPSS software package to produce quantitative results.

It should be highlighted that eighteen (18) participants responded to questionnaire 1; fifteen (15) responded to questionnaire 2; and fifteen (15) responded to questionnaire 3.

##### 4.2.1 Create an ePortfolio

During training session 1, namely, ‘Create an ePortfolio’, the CIECT team equipped participants with eSkills to enable them to create their ePortfolios. They populated these spaces with background information; daily experiences related to the specific disciplines; and related evidence: transcripts, journals and videos.

ePortfolios facilitate the process of collecting, reflecting on, sharing and presenting learning outcomes and other professional accomplishments via a digital medium (Fitch *et al*, 2008). The study examined the participants’ perception on the pedagogical value of the creation of an ePortfolio.

As depicted in Table 3, the ePortfolio was perceived as contributing effectively to learning. The participants felt that the content was covered sufficiently (mean = 3.78). Their expectations and needs were adequately met (mean = 3.72); the topics were relevant (mean = 3.72); the training added value (mean = 3.61); and the application of the training in the workplace would be possible (mean = 3.47).

All participants were satisfied with training session 1. It should be noted that one participant felt that he would require more time in the workplace to practice newly acquired skills in order to become more confident.

**Table 3:** ePortfolio research results

	No of participants		Benefits of training
	Valid	Missing	Mean*
To what extent were your expectations and needs met?	18	0	3.72
To what extent were the topics relevant and appropriate to your needs?	18	0	3.72
To what extent was the content covered sufficient in this training?	18	0	3.78
To what extent did the training add value to your understanding of the topics covered?	18	0	3.61
To what extent will you be able to apply the training in the workplace?	17	1	3.47

\*The answer's scale was 1 = no satisfaction – 4 = extreme satisfaction

Other comments from respondents are:

- *“I found the training very helpful, broadened my mind to new possibilities”*
- *“Great explanation and assistance on floor was very helpful”*
- *“All the essentials were covered to take us further”*
- *“Good workshop, easy to follow and lots to look forward to”*

#### 4.2.2 Create an interactive online course

During training session 2, namely, create an interactive online course, the institutional Learning Management System (LMS), SAKAI was used as a mode of delivery. The lecturers were trained on how to create an online course for their prospective students. The online space enabled participants to keep students updated with the latest course related information and announcements; share relevant course material; create lessons linked to relevant resources (internal and external resources); and further create a safe space for students and lecturers to engage in discourse around specific Science concepts. The research questionnaire was circulated immediately after the training and the results are discussed below.

Table 4 indicates that most of the respondents were generally satisfied about the hands-on training and support experiences. The training intervention has left respondents thinking of ways of integrating their curriculum, as well as some challenges pertaining to the familiarity of the eTools; and application thereof. It should be noted that 20% of the respondents indicated that they would not be confident to apply after the training:

- *“the training was very important as it has added value to old ways of teaching... it would assist to meet the audience and improve the quality of teaching-and-learning”.*
- *“I will be able to interact with the students using the system at any given time”.*
- *“how are we going to apply eLearning for Phy151 as for our work is chalk and board work? It also takes time for students especially first year to get used to computers”.*
- *“I got lost on some of the sections as the presenter was too fast... my computer did not have plugins to play videos”*

**Table 4:** Create an interactive online course: research results

	No of participants	Benefits of training
		Mean*
To what extent were your expectations and needs met?	15	3.60
To what extent were the topics relevant and appropriate to your needs?	15	3.73
To what extent was the content covered sufficient in this training?	15	3.47
To what extent did the training add value to your understanding of the topics covered?	15	3.47
To what extent will you be able to apply the training in the workplace?	15	3.27

\*The answer's scale was 1 = no satisfaction – 4 = extreme satisfaction

It should be highlighted that the institutional LMS is integrated with mobile technologies. Users (lecturers and students) are able to view and engage in course content; complete assessments and engage in discussion topics via their mobile devices. Hence, training session 3 was intended to familiarise the lecturers with innovative mobile devices, such as iPads and tablets – to access and engage with course content.

#### 4.2.3 Make use of mobile integration devices

The main purpose for this training session 3 was to introduce mobile learning or the use of mobile technologies to access and interact with the subject-matter. Participants were given hand held mobile devices (iPads and android tablets). The interactive training intervention equipped the participants with basic navigation skills ('the know-how') – in order for them to access and actively engage with subject matter (text, video, and graphics) - via these devices.

The participants enjoyed this training intervention. Almost all the respondents (14 out of 15) (93.3%) felt that their expectations and needs were met, as it made them think about innovative ways of instruction; and especially the infusion of ICTs into the curriculum. It should be noted that one participant felt that the training content for this session was not adequate.

Table 5 shows results on the benefits of the mobile training intervention; as the participants were able to make use of the available iPads and tablets during this hands-on session. Moreover they were expected to think about the use of these mobile devices to access their online learning environments (ePortfolios and online classrooms).

**Table 5:** Make use of mobile integration devices

	No of participants	Benefits of training
		Mean*
To what extent were your expectations and needs met?	15	3.93
To what extent were the topics relevant and appropriate to your needs?	15	3.73
To what extent was the content covered sufficient in this training?	15	3.87
To what extent did the training add value to your understanding of the topics covered?	15	3.87
To what extent will you be able to apply the training in the workplace?	15	3.67

\*The answer's scale was 1 = no satisfaction – 4 = extreme satisfaction

The results indicate that the lecturer assistants began to think about the infusion of ICT in the Science Faculty at the University of the Western Cape during the three (3) day workshop, covering the creation of an ePortfolio, an online course; and mobile devices. Furthermore, the research results indicated that the training and support of the lecturers by the CIECT team - during face-to-face training interventions - added to the overall success of the Programme. The success of ICT infusion in a higher education setting depends on, “integrated institutional ICT infrastructure and systems with dedicated front-end and backend support capacity and processes” (Stoltenkamp 2011).

Moreover, the CIECT team observed that the lecturers’ attitude toward the training and support interventions played a major role in the overall success of the Programme. The use of technology in HEIs has emerged as an innovative initiative which requires proactive adopters to go through “the process in which an individual passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision” (Rogers 2003). The overall training Programme indicates how institutions can engage in discourse related to the infusion of ICTs into the curriculum; as it “gives better value to students” (Daniel 1997:17 cited in Miller, Martineau, and Clack 2000).

## 5. CONCLUSION

The paper reflects on the results of a training Programme which endeavoured to emphasise the infusion of ICT into the Science curriculum within a higher education setting. The results were indicative of the benefits of the overall Programme, Faculty of Science Teaching Assistants Development Programme (FSTADP). As participants engaged in the training, they became familiar with various eTools to supplement their instruction. The support provided by the CIECT team, motivated them to actively and confidently engage with the content, eTools and mobile devices.

As a result, the lecturer assistants were able to create ePortfolios and online courses. The researchers found that the face-to-face training interventions played an important role, as they demystified the perceived complexity or technophobia; and encouraged hands-on experiences and demonstrations (Njenga 2011). The training also provided, as stated by Hubbard and Sandmann (2007), that the lecturers were able to view the results of their implemented practices.

Most of all, the researchers have emphasised that there is still a need for face-to-face training and support, supplemented with online support interventions – in order for lecturers to successfully engage in the discourse related to the infusion of ICTs, and the actual implementation thereof. The design and facilitation methods implemented by CIECT have encouraged lecturer-student relations through a phased approach, assessment tasks and ongoing support throughout the programme. Hence, lecturer assistants were not only provided with ICT skills but also introduced to a method of implementing the application of ICT into their own teaching-and-learning practices which embraces the lecturer-student relationship.

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