Technologies for foreign language learning: a review of technology types and their effectiveness

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Abstract

- A summary of **evidence for the effectiveness** of technology use in foreign language (FL) learning and teaching

- Review of over **350 studies:** classroom-based technologies, individual study tools, network-based social computing, and mobile and portable devices

- Despite limited evidence of efficacy, measurable impact was found in studies on **computer-assisted pronunciation training** (**automatic speech recognition, ASR)** and **chat.**

- Moderate improvement in learners' **output and interaction, affect and motivation, feedback, and metalinguistic knowledge** was also found.

Introduction

- 외국어 학습에서 테크놀로지 활용 시 예상되는 **효과와 부작용**은 무엇일까?
- 효과: learner interest and motivation, increased access to target language input, interaction opportunities, feedback, efficient means for organizing course content
- 부작용: inappropriate input, shallow interaction, inaccurate feedback, technical frustration, distraction, over-emphasis on delivery modality over learning objectives

- **Computer-assisted language learning (CALL):** 30 여 년간 연구된 주제
- → 그러나, 통일된 research agenda, 지속적이고 유효한 연구결과 부족
- → 연구 설계, 변인 선택, 연구 참여자 정보 부족, 기술 관련 훈련 부족, 전반적 체계성 부족 등 문제가 존재함
- → 외국어 교수학습에서 테크놀로지 활용의 효능에 대한 평가의 어려움

Introduction

- **Focus and scope of this review**
  - Empirical studies that include **research-based evidence** showing that technology was effective
  - Excluding personal computer and existing technologies that have been available for use in teaching for at least a few decades (TV, videotapes, etc.)

- **Strength of evidence**
  - **strong, moderate, and weak empirical support** for the effectiveness of technology use in FL learning and teaching

  * "Non-experimental": observational, case studies, studies with <u>no control group</u>
  * "Experimental": studies with treatment, <u>control groups</u>, random assignment

Introduction

Table 2. Strength of empirical support for claims of effectiveness.

Strength	Definition
Strong	• Three or more corroboratory well-designed experimental, quantitative non-experimental, qualitative, or mixed methods studies
Moderate	• A single well-designed experimental, quantitative non-experimental, qualitative, or mixed methods study; OR • Two or more well-designed experimental, quantitative non-experimental, qualitative, or mixed methods studies with partially contradictory evidence; OR • Two or more experimental, quantitative non-experimental, qualitative, or mixed-methods studies with design limitations, such as a low number of participants
Weak	• A single well-designed study of any kind with contradictory evidence or with design limitations; OR • Expert opinions based on theory or own practice but not empirical data; OR • Studies with flaws in methodology or methodology not discussed in detail

Evidence: 1) Schoolhouse/classroom-based technologies

• **Course/learning management system (CMS/LMS)**

- Server-based application used to present materials and services required for blended or distance learning

[Research findings]

- CMS users became more <u>independent and more confident</u> learners, developed their <u>sense of autonomy</u> (Sanprasert, 2009)

- "the most significant innovation that improve the quality and depth of <u>student involvement</u> ... and academic reading comprehension and academic writing production" (Carey, 1999)

Evidence: 1) Schoolhouse/classroom-based technologies

- **Interactive white board**

- An <u>interactive display</u> that comprises of a computer, a projector, and a display panel

[Research findings]

- The majority of evidence comes from qualitative studies with <u>self-report data & classroom observations</u>

- <u>No studies</u> reported learning outcomes

→ Some evidence regarding the impact on the **process of learning and learner affect** (independence, more practice and recycling of already learned material, etc.)

- **"Wow" factor**: students' enthusiasm, interest and engagement attracted attention (Orr, 2008; Tozcu, 2008; Schmid, 2007)

Evidence: 1) Schoolhouse/classroom-based technologies

- **ePortfolio**

  - A digital archive of student work with evidence of the learner's experiences, progress, achievements, and self-reflections

  [Research findings]

  - Qualitative studies based on participant self-report; therefore, no learning outcomes

  - Advantages: self-assessment, reflection, enhanced collaboration, easy update

  - Disadvantages: extremely time-consuming, some implementation barriers, students' lack of motivation and willingness to use (Little & Perclova, 2001; Kocoglu, 2008)
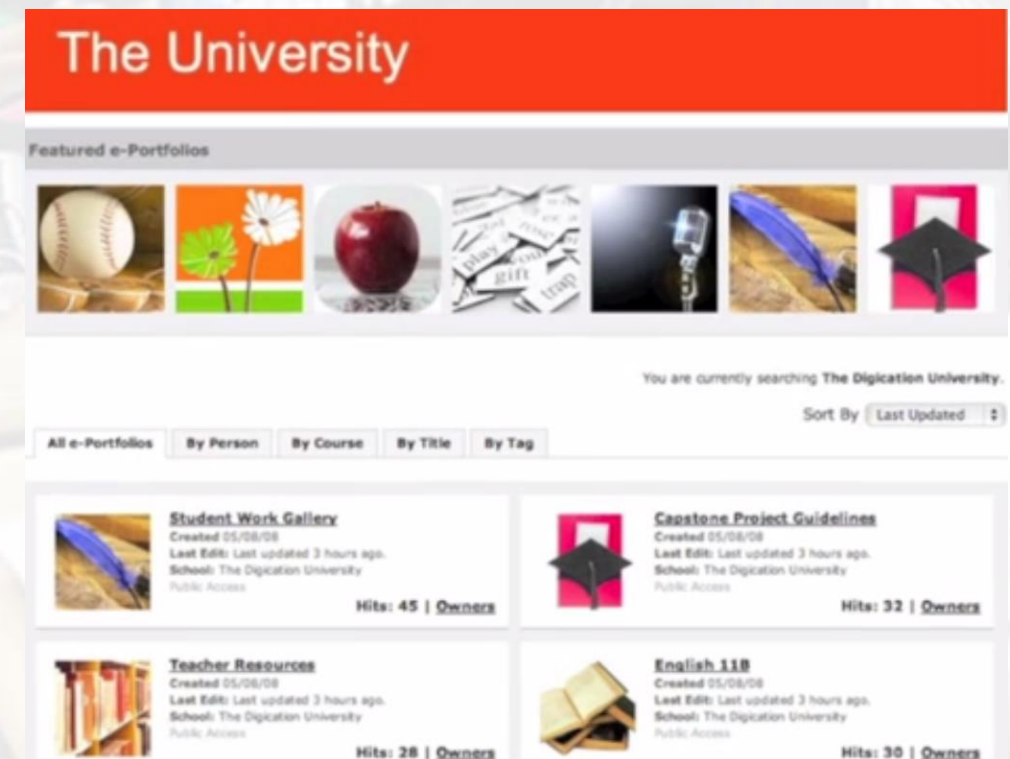
Evidence: 2) Individual study tools

- **Corpus**

- A collection of <u>authentic language</u> in spoken form, written form, or both

- Example of **British National Corpus**

- 언어학에서는 **코퍼스와 인공지능을 활용한 통번역 시스템** 개발 연구도 진행되고 있음

→ 한국번역학회: '한국형 인공지능 음성인식 및 번역시스템 개발'

→ "<u>병렬 코퍼스(Parrel Corpus,병렬말뭉치) 기술을 기반으로 한 세계에서 가장 정확하고 빠른 한-영 AI통역엔진 개발</u>에 성공했다. "

- AI코퍼스 신한진 대표

http://www.g-enews.com/ko-kr/news/article/news_all/20160826110252997 9140_1/article.html
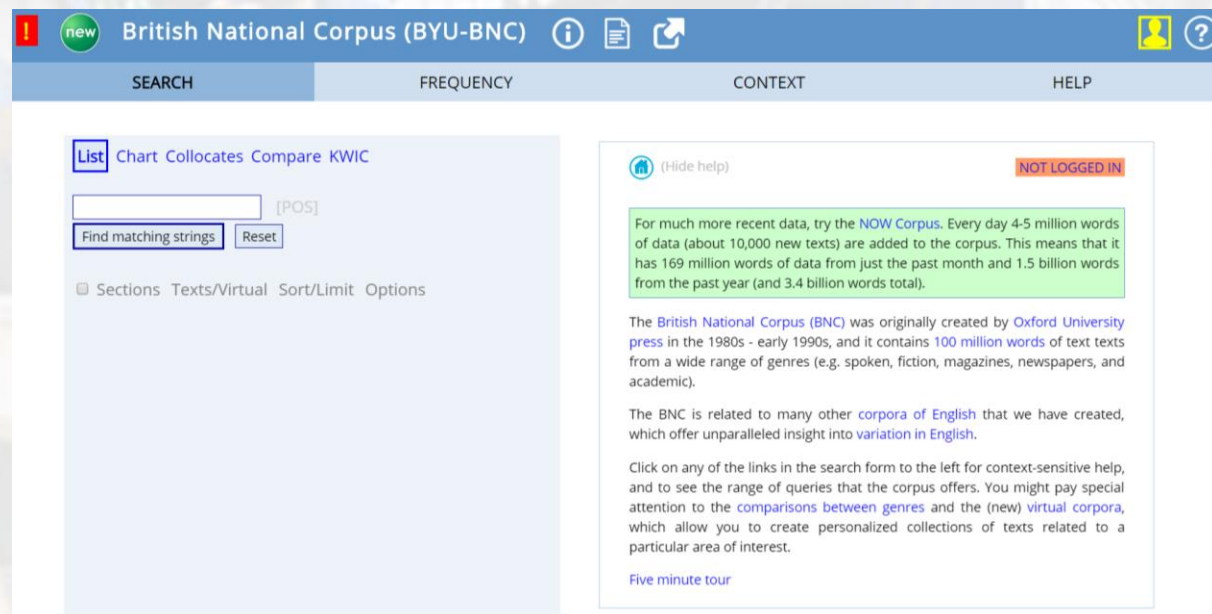
Evidence: 2) Individual study tools

- **Corpus**

  [Research findings]

- Qualitative studies with self-report data, or case studies

- Some learners thought that the technology was beneficial (Farr, 2008) and the use of corpora promoted their language awareness, command of lexicogrammatical(어휘문법) rules and patterns, awareness of context, and discovery learning (Liu & Jiang, 2009).

- Concerns about technological skills and the amount of time needed to use the software were also expressed (Farr, 2008)

- Some suggested that corpora may be successfully used by linguistics students or students at the advanced level, but not at lower levels(Kennedy & Miceli, 2001).

Evidence: 2) Individual study tools

- **Electronic dictionary**

- A dictionary in electronic form – either handheld or online

 [Research findings]

- Numerous quantitative and qualitative studies conducted

- Learners who used electronic dictionaries were <u>significantly faster at completing reading tasks and understood significantly more</u>(86.10 vs. 62.70%) than the users of paper dictionaries. (Aust, Kelley, & Roby, 1993; Koyama & Takeuchi, 2007; Leffa, 1993).

- <u>More word lookup with no disturbance</u> of the reading process itself (Aust et al., 1993; Koyama & Takeuchi, 2007; Laufer & Levitsky-Aviad, 2006)

- <u>Retention</u> of words looked up: mixed results (Laufer and Hill, 2000; Koyama and Takeuchi, 2004; Peters, 2007)

- <u>Learner attitudes</u>: strong preference of electronic dictionaries, <u>more positive attitude and willingness</u> to read (Aust et al., 1993; Laufer & Levitsky-Aviad, 2006; Liou, 2000; Loucky, 2005).

Evidence: 2) Individual study tools

- **Electronic gloss or annotation** (전자 주석)

- A method of <u>reference,</u> usually in a form of a <u>hyperlink</u>, that allows learners to access glosses or annotations <u>while reading an electronic text</u>

- Possible to provide <u>context-specific definitions or translations </u>without recreation of the word or decision among multiple definitions or translations for a word

[Research findings]

- Took <u>half the time </u>to complete the reading tasks & <u>higher comprehension scores </u>(Hong, 1997)

- A <u>combination of text+picture glosses </u>seems to be more effective

- Students perceived electronic annotations to be <u>useful, enjoyable, interesting</u>, <u>easy to understand</u> and made them more <u>independent and read faster</u>.
(Ariew & Ercetin, 2004; Davis & Lyman-Hager, 1997; Chun, 2001).
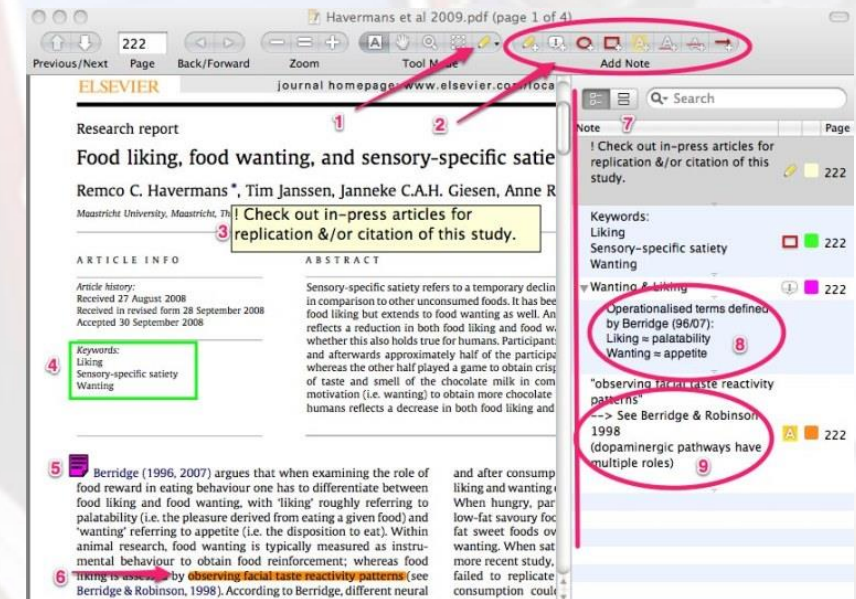
Evidence: 2) Individual study tools

- **Intelligent tutoring system**

- A program that simulates a tutor by providing direct, customized instruction and/or feedback to a learner

- Four components of ITS: an interface(platform), an expert model(domain of knowledge), a student model(current state of student's knowledge), and a tutor model (provides feedback and instruction by identified gaps between the student and the expert models)
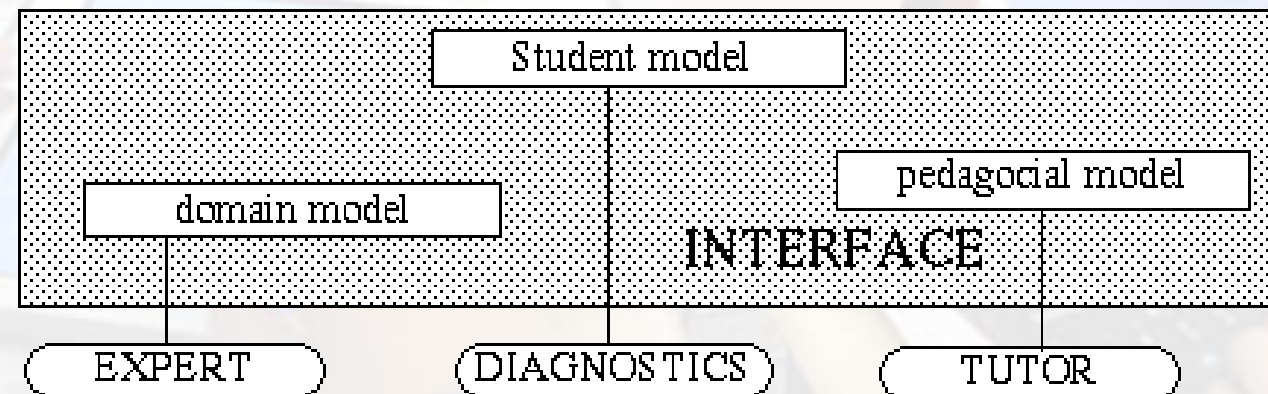
Evidence: 2) Individual study tools

- **Intelligent tutoring system**

  [Research findings]

  - More effective feedback in learning particles(불변화사) and complex structures (Nagata, 1993; 1997)

  - An average 83% reduction in errors (Dodigovic, 2007)

  - Communicative context, corrective feedback, and the diagnostic value of learner errors (MacWhinney, 1995)

  - Increase in motivation and confidence (Harless, Zier, & Duncan, 1999; Holland, Kaplan, & Sabol, 1999)

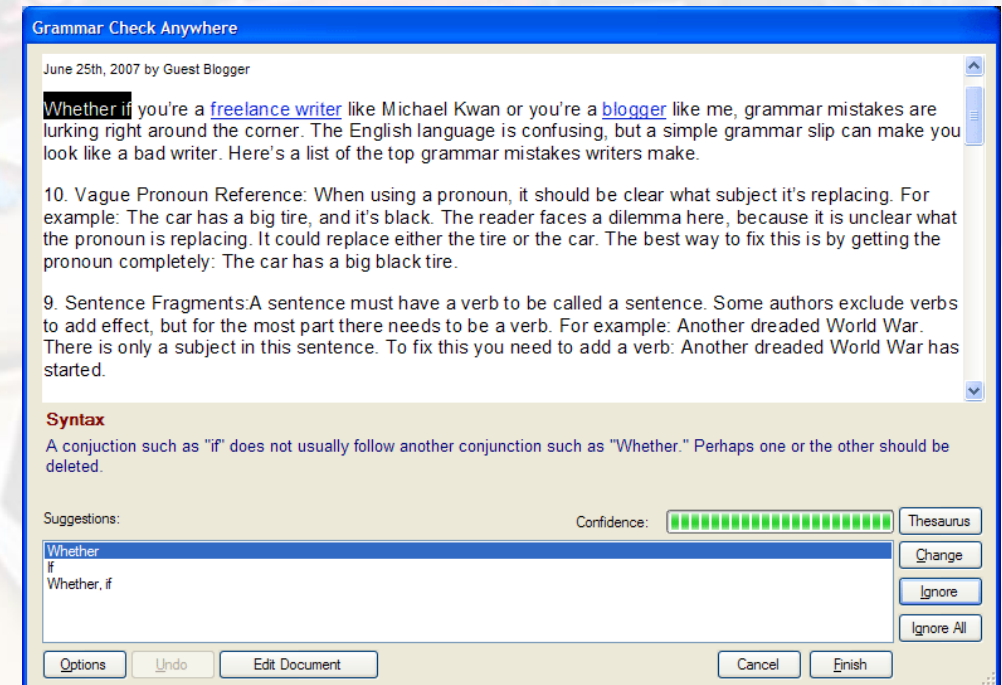# Evidence: 2) Individual study tools

- **Grammar checker**

- Often packaged, along with spellcheckers, within wordprocessing programs

[Research findings]

- Language learners <u>need training</u> in order to use this technology effectively.

➔ After the training session, the group using the <u>paper references</u> and the group using the <u>grammar checker</u> performed with <u>comparable accuracy</u>. But not before it! (Jacobs and Rogers, 1999)

Grammar Check Anywhere

June 25th, 2007 by Guest Blogger

<u>Whether if</u> you're a <u>freelance writer</u> like Michael Kwan or you're a <u>blogger</u> like me, grammar mistakes are lurking right around the corner. The English language is confusing, but a simple grammar slip can make you look like a bad writer. Here's a list of the top grammar mistakes writers make.

10. Vague Pronoun Reference: When using a pronoun, it should be clear what subject it's replacing. For example: The car has a big tire, and it's black. The reader faces a dilemma here, because it is unclear what the pronoun is replacing. It could replace either the tire or the car. The best way to fix this is by getting the pronoun completely: The car has a big black tire.

9. Sentence Fragments:A sentence must have a verb to be called a sentence. Some authors exclude verbs to add effect, but for the most part there needs to be a verb. For example: Another dreaded World War. There is only a subject in this sentence. To fix this you need to add a verb: Another dreaded World War has started.

Syntax

A conjuction such as "if" does not usually follow another conjunction such as "Whether." Perhaps one or the other should be deleted.

Suggestions: Confidence: ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮   Thesaurus

Whether   Change
If
Whether, if   Ignore

                                                                                                Ignore All

Options   Undo   Edit Document   Cancel   Finish

Evidence: 2) Individual study tools

- **Automatic speech recognition (ASR) and pronunciation program**

- identifies particular parameters of the learner's output, such as prosody(운율) or specific sounds, and provides feedback on these aspects of performance

- Example of **Tell me more**
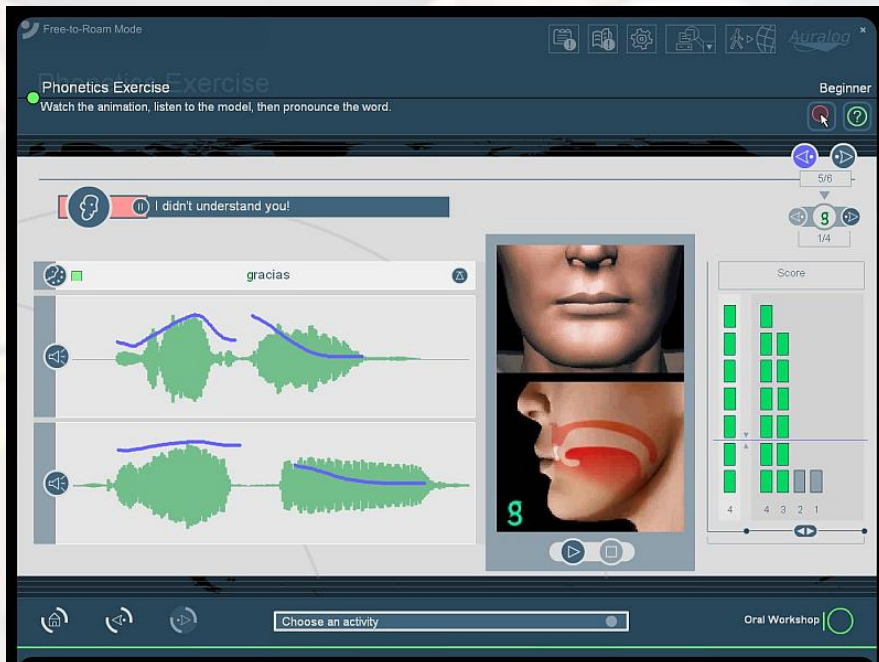
Evidence: 2) Individual study tools

- **Automatic speech recognition (ASR) and pronunciation program**

  [Research findings]

  - When students <u>record their speech and acoustically analyze it</u>, <u>comparing</u> their pronunciation and prosody(운율) <u>to a **native speaker sample** using **visual feedback**,</u> the prosody and vowel pronunciation was improved(M. Carey, 2004; Hardison, 2004).

  - Increase in speaking <u>confidence and awareness</u> of prosody (Hardison, 2004).

  - Low correlations between the software scores and the human scores (Kim, 2006; Machovikov, Stolyarov, Chernov, Sinclair, & Machovikova, 2002; Rypa & Price, 1999).

  → ASR and CAPT still have a long way to go before it can replace human interaction(Kim, 2006).

Evidence: 3) Network-based social computing

- **Virtual world or serious game**

- Virtual world: a program that allows learners to move a representation of a character (or "avatar") through a 3-D graphical environment

- Serious game: a virtual environment or traditional computer game with guided or restricted activities and specified goals

→Example of **Tactical Language & Culture Training System** by US military

Evidence: 3) Network-based social computing

- **Virtual world or serious game**

[Research findings]

✓ **Virtual worlds**

- No clear evidence that learning in virtual worlds is more effective

- Existing studies primarily reporting affective reactions or students' opinions

- Lack of control groups using traditional methods makes it impossible to evaluate effectiveness

✓ **Immersive games**

- Tactical Iraqi^{TM}: significant improvement in declarative knowledge of the language and culture (Surface, Dierdorff, and Watson, 2007)

→ It is recommended that they be part of a "structured language program"

- Video game players learned less vocabulary than students who passively watched it

→ Due to **cognitive load** required to work the game (deHaan, Reed, & Kuwada, 2010).

Evidence: 3) Network-based social computing

- **Chat**

- A form of <u>synchronous computer-mediated communication</u> (text-based or audio)

   [Research findings]

- Written chat: <u>more complex output and a wider variety of strategies</u> used than voice chat or face-to-face discussion groups (Sykes, 2005; Kern, 1995; Warschauer, 1996)

- Students who <u>practiced with written chat</u> subsequently produced the <u>greatest quantity</u> of output in posttest face-to-face discussions (Abrams, 2003)

- → May be due to <u>having more time to construct and practice complex structures</u> because of the <u>natural delay</u> in written chat interactions

- Increase in focus on form, and the salience(부각) of student errors and feedback
   (Lai & Zhao, 2006; Lee, 2008; Shekary & Tahririan, 2006)

Evidence: 3) Network-based social computing

- **Asynchronous communication tools**

- blogs, wikis, Internet forums, and discussion or message boards

- Less opportunities for <u>negotiation of meaning</u>, <u>greater time</u> for processing of language input, thoughtful TL output, and <u>learner self-correction</u> (Kitade, 2008; Levy & Stockwell, 2006; Warschauer, 1997)

- Empirical evidence supports the <u>viability(실현가능성)</u> of asynchronous communication as a mode of FL learning, rather than providing <u>solid evidence of its effectiveness</u>.

- **Social networking**

- Unknown effects on language learning

- No study on the use of social networking for language learning that included <u>data on language use</u>

Evidence: 3) Network-based social computing

- **Blog**

- Very few quantitative studies, with no studies including a control group

- In qualitative studies, students' preference for blogging, motivation, improvement in writing have been reported (Armstrong & Retterer, 2008; Thorne et al., 2005)

- Reading and commenting on native speakers' blogs increased students' confidence, creativity and reflection on their own language production and proficiency gains (Ducate & Lomicka, 2005, p. 419, 2008; Thorne & Payne, 2005).

- Students' perception of blogging as self-presentation, information exchange, and social networking (Sun, 2009)

- Challenge of assessing and evaluating the learning

➔ Creativity and subjectivity issues (Mardomingo, 2009)

Evidence: 3) Network-based social computing

- **Internet forum or message board**

- Limited feedback on learner output (Ware & O'Dowd, 2008)
→ Careful design of feedback in the task is needed

- **Wiki**

- Limited empirical evidence, mostly in the form of case studies in collaborative L2 writing

- Uneven distribution of participation with a small number of active students

- Greater attention paid to simple editing than writing acts that require more critical thinking
(Kessler, 2009; Kessler & Bikowski, 2010).

→ Teachers' active involvement required to ensure successful collaboration among students
(Ioannou & Artino, 2008; Lund & Smørdal, 2006)

Evidence: 4) Mobile and portable devices

- **Tablet PC or PDA**

- In a collaborative, peer-assisted learning in small reading groups, groups with the tablets <u>attended more to the reading tasks, and exhibited more collaborative behaviors</u> (Lan, Sung, and Chang, 2007)

- Significant improvement in reading comprehension, vocabulary recall, listening and speaking skills was reported (Chen and Hsu, 2008; Chen and Chung, 2008; Liu, 2009)

- **iPod**

- No empirical evidence of the effectiveness, some data on students' affective or motivational responses

- Convenience of iPods(90%), benefits of working with an iPod(91%), motivation(67%);
no correlation between students' reported attitudes and their GPA
(Sathe & Waltje, 2008)

Evidence: 4) Mobile and portable devices

• **Cell phone or smartphone**

- Focusing primarily on the use of the Short Message System (SMS) feature

① SMS group significantly outperformed Web and paper groups on <u>immediate vocabulary recall measures</u> but not on delayed ones (Lu, 2008; Thornton & Houser, 2002, 2003, 2005)

② Vocabulary drills completed via SMS consistently <u>took more time</u> (Stockwell, 2009)

→ Compact format of the mobile devices, distracting environments

- Students' attitudes: majority preferred the SMS instruction, wished to continue such lessons, and believed it to be a valuable teaching method (Thornton & Houser, 2002, 2003, 2005)

Evidence summary

Claim	Supporting study or studies	Technology type	Support
Enhanced input and comprehension			
Technology enhances learners' comprehensibility of input	Leffa (1993)	Electronic dictionary	Weak
Technology enhances L2 reading comprehension	Taylor (2006, 2009)	Electronic gloss and annotation	Weak
	Chen and Hsu (2008)	PDA	Weak
Enhanced output and interaction			
With technology, learners improve pronunciation efficiently	M. Carey (2004); Hardison (2004); Hirata (2004)	Automatic speech recognition	Strong
With technology, learners' language production increases, both in terms of amount and complexity	Kern (1995); Sullivan and Pratt (1996); Warschauer (1996)	Chat	Strong
With technology, learners demonstrate pretest–posttest gains in different areas, including speaking, reading comprehension, vocabulary, grammar, fluency	Chiu et al. (2007); Harless et al. (1999); Holland et al. (1999)	Intelligent tutor	Moderate
With technology, learners complete tasks faster than without technology	Aust et al. (1993); Koyama and Takeuchi (2007); Leffa (1993)	Electronic dictionary	Moderate
	Hong (1997)	Electronic gloss and annotation	Weak
With technology, frequency of dictionary look-ups increases	Aust et al. (1993); Koyama and Takeuchi (2007)	Electronic dictionary	Moderate
Technology enhances L2 speaking proficiency	Blake (2009); Payne and Ross (2005); Payne and Whitney (2002); Satar and Özdener (2008)	Chat	Moderate
With technology, learners acquired more vocabulary words than with	Thornton and Houser (2002, 2003, 2005)	Cell phone (SMS)	Moderate
Web- or paper-based training			
With technology, accuracy of learners' FL production improves	Dodigovic (2007)	Intelligent tutor	Weak
	Burston (2001); Jacobs and Rogers (1999)	Grammar checker	Weak

Evidence summary

Claim	Supporting study or studies	Technology type	Support
With technology, learners attend more to reading tasks	Lan et al. (2007)	Tablet PC	Weak
Technology facilitates collaboration	Ioannou and Artino (2008); Lund and Smørdal (2006)	Wiki	Weak
	Lan et al. (2007)	Tablet PC	Weak
With technology, frequency of edits of own writing increases	Yoon (2008)	Corpus	Weak
With technology, learners tend to experiment with TL in ways not observed in traditional writing assignments	Ducate and Lomicka (2008)	Blog	Weak
With technology, learners can increase their knowledge of TL language and culture	Surface et al. (2007)	Serious game	Weak
Enhanced feedback			
Intelligent feedback is more effective than traditional feedback	Nagata (1993, 1997)	Intelligent tutor	Moderate
With technology, learners can obtain immediate corrective and targeted feedback	Dodigovic (2007)	Intelligent tutor	Weak
Enhanced affect and motivation			
Learners prefer working with technology over traditional non-technological materials	Armstrong and Retterer (2008)	Blog	Moderate
	Aust et al. (1993); Laufer and Levitsky-Aviad (2006); Liou (2000); Loucky (2005)	Electronic dictionary	Moderate
With technology, learners are more motivated and engaged in the process of learning	Gray et al. (2005); Orr (2008); Tozcu (2008)	Interactive white board	Weak

Evidence summary

Claim	Supporting study or studies	Technology type	Support
Learners prefer SMS over Web or paper-based methods	Lu (2008); Thornton and Houser (2002, 2003, 2005)	Cell phone (SMS)	Weak
With technology, students enjoy the process of learning	Shih and Yang (2008)	Virtual world	Weak
Technology facilitates confidence in producing in TL	Davis and Lyman-Hager (1997)	Electronic gloss and annotation	Weak
	Ducate and Lomicka (2008)	Blog	Weak
With technology, students are motivated to spend more time on learning activities	Sathe and Waltje (2008)	iPod	Weak
Enhanced metacognition			
With technology, learners are more likely to correct their errors than in face-to-face conversation	Lai and Zhao (2006)	Chat	Weak
Technology helps students become independent and confident learners	Sanprasert (2009)	CMS	Weak
(Asynchronous) technology enables more time for reflection, processing of input, and editing	Kitade (2008)	Bulletin board/asynchronous chat	Weak
Enhanced metalinguistic knowledge			
Technology can promote noticing and focus on form	Chen (2008); Kitade (2000); Lee (2008); Shekary and Tahririan (2006)	Chat	Moderate
Technology enhances learners' command of grammatical rules and language awareness	Liu and Jiang (2009)	Corpus	Weak

Conclusion & Discussion

- Most research focused on the **viability(affordances)** rather than **efficacy(effects)**

→ <u>Actual increases in learning or proficiency</u> should be demonstrated

- Difficulty of carefully **controlled studies** of language learning

→ Need for an analysis of <u>converging evidence from multiple studies</u>

→ **혼합 연구를 통한 통합적 분석, 메타 연구**

- Direction of computer-assisted language learning(CALL) research:

Basic description of **what technology can do**	→	**What it should do** and **when and how different technologies can best be used** to support learning	→	**교수설계, 처방적 연구** (형성, 설계개발 연구 등) 중요성

- End of Presentation -