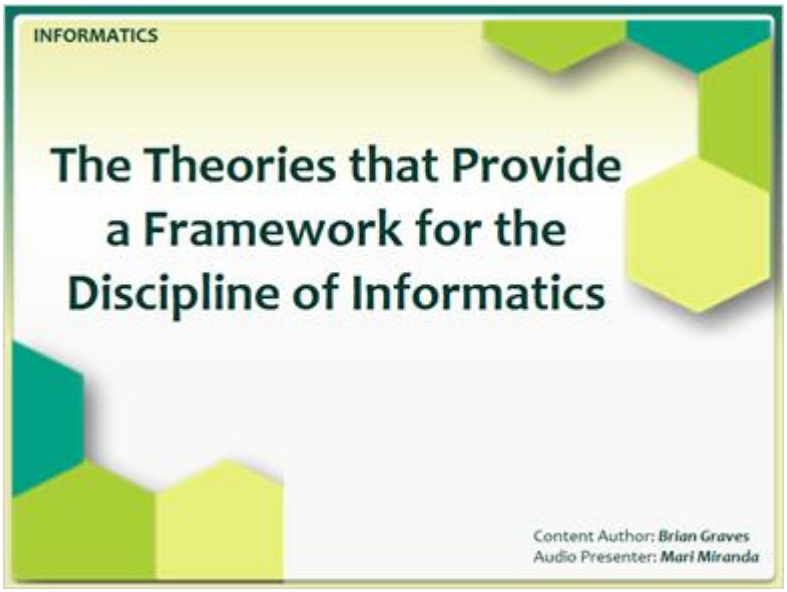
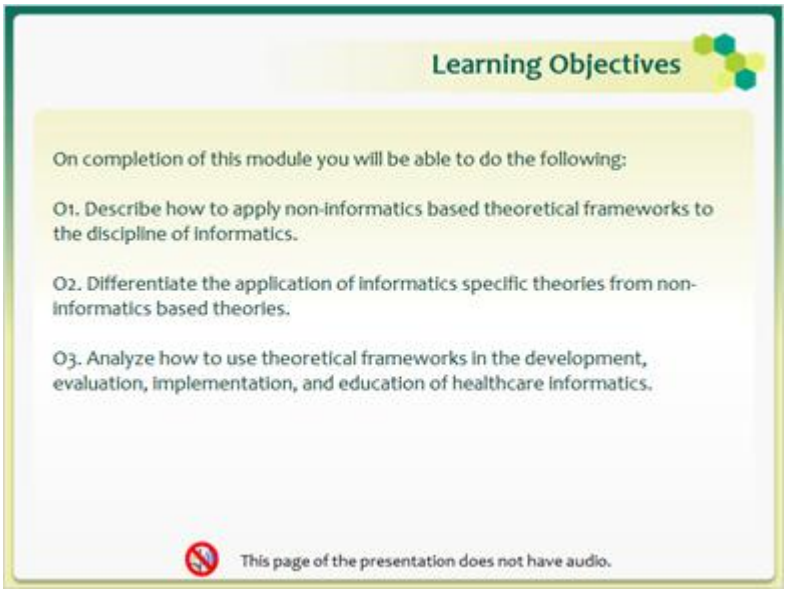
Informatics: Theoretical Framework

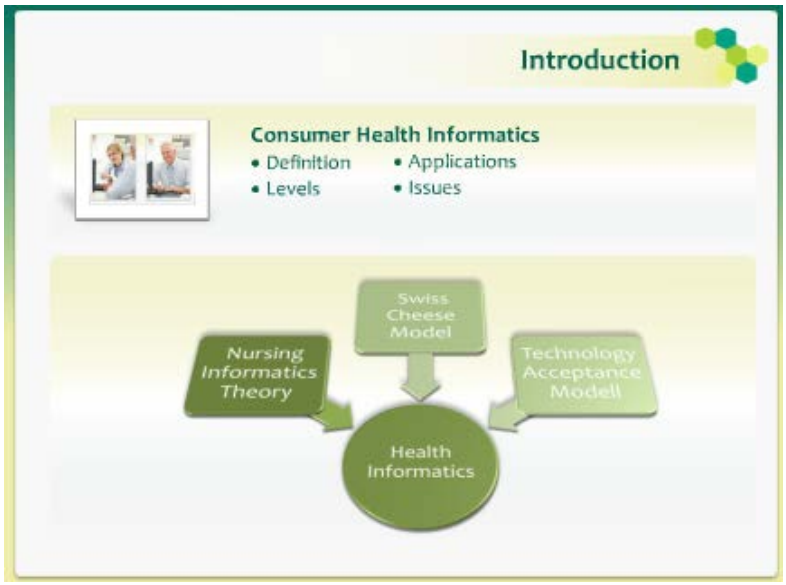


Notes:

Learning Objectives



Introduction



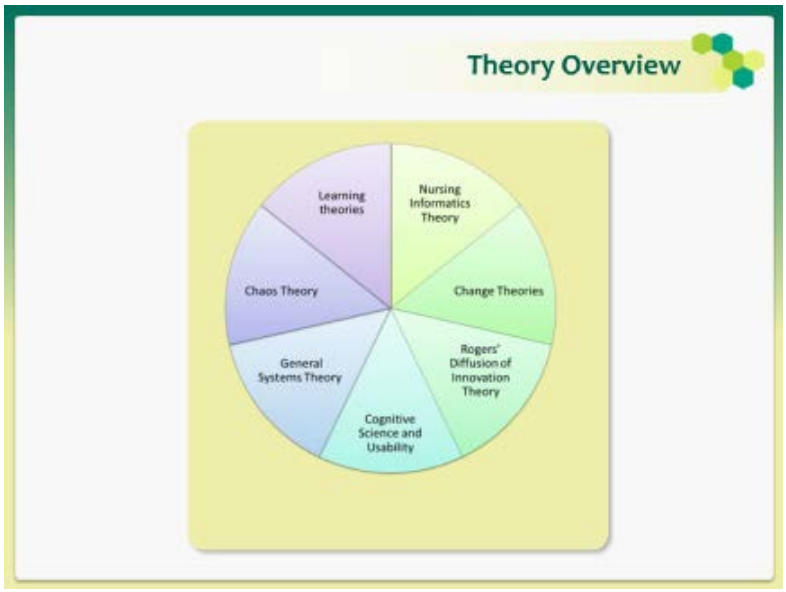
Notes:

Welcome to "The theories that provide a framework for the discipline of informatics" module. In the Consumer Health Informatics module, you learned what consumer health informatics is and the different levels associated with it. Applications and issues with consumer health informatics were also discussed.

Previously in this course you have learned about a number of informatics specific and non-informatics specific theoretical frameworks and evaluation models that can be utilized to inform the science of health informatics, such as the Nursing Informatics Theory, Swiss Cheese Model, and Technology Acceptance Model.

In this module you will learn about additional theoretical frameworks that can be applied to the discipline of informatics. Resources will be provided that can be integrated into the development, evaluation, implementation, and education of healthcare informatics.

Theory Overview



Notes:

There are many theories that lend themselves to the support of Informatics, Health Informatics, and Nursing Informatics. Examples include (Sewell & Thede, 2010): Nursing Informatics Theory, Change Theories, Rogers' Diffusion of Innovation Theory, Cognitive Science and Usability, General Systems Theory, Chaos Theory, and learning theories. In the context of contributions to informatics, these theories are not necessarily mutually exclusive. Integrated together, the theories help to inform the science of health informatics in a more comprehensive way.

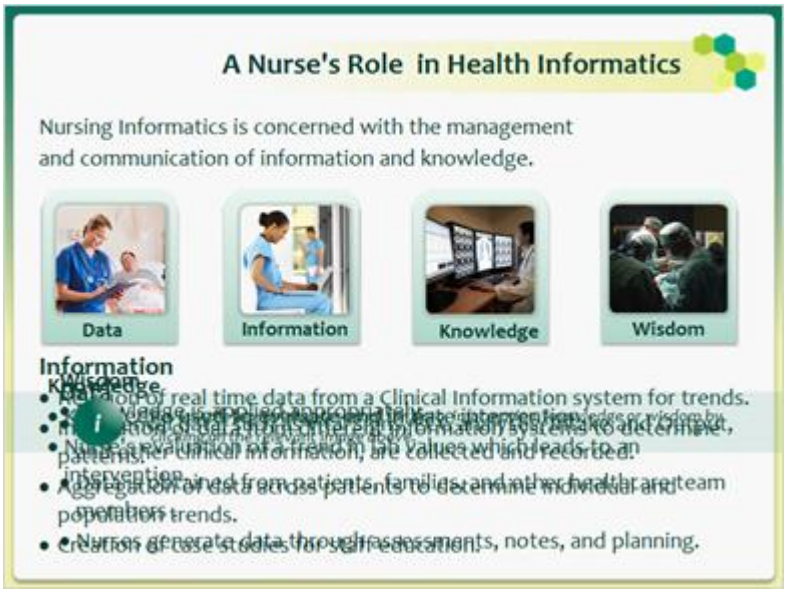
References for all of the theories above can be found on the Resources page.

Health Informatics Theory

Notes:

Some examples of how theories have informed the informatics field have been discussed in previous modules.

A Nurse's Role in Health Informatics



Notes:

Nurses really intersect at both the Health Informatics and Nursing Informatics level. As stated in both definitions from the ANA and the AMIA, Nursing Informatics is concerned with the management and communication of information and knowledge. Let's first take a look at what information and knowledge are.

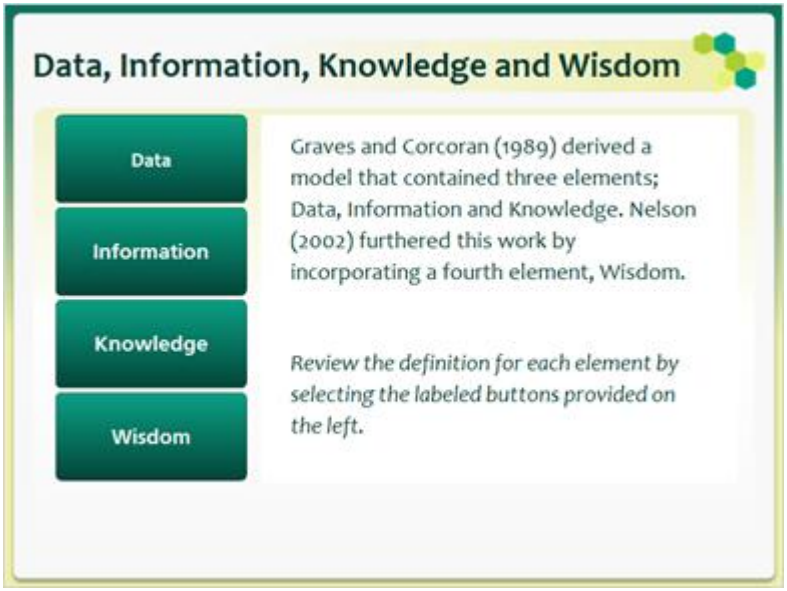
Data is the building block in all of informatics. Without data, information cannot be generated and knowledge cannot be formed. Nurses provide data in many different ways. Nurses collect numerical data through recording and entering vital signs, ECG analyses, Intake and Output, and other clinical information. Nurses also obtain data from patients, families, and other healthcare team members which is also recorded. Nurses generate data through assessments, notes, and planning.

Nurses utilize this data to generate information. Nurses do this by reviewing real time data from a Clinical Information system for trends, by integrating data from different information systems, such as lab and radiology systems, to determine patterns, by aggregating data across patients to determine individual and population trends, or by creating case studies for staff education. These are but a few examples of how nurses generate information.

Once this information has been generated it is then synthesized into knowledge, which is used to evaluate and initiate intervention. When a nurse evaluates a trend in lab values that then leads to an intervention it is considered knowledge.

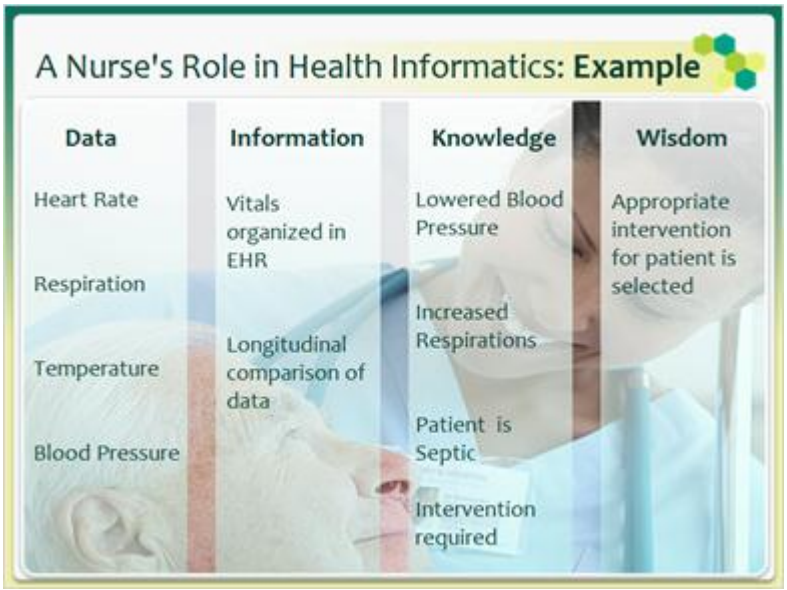
Wisdom is then the culmination of this process, where the knowledge is applied appropriately.

Definitions



Notes:

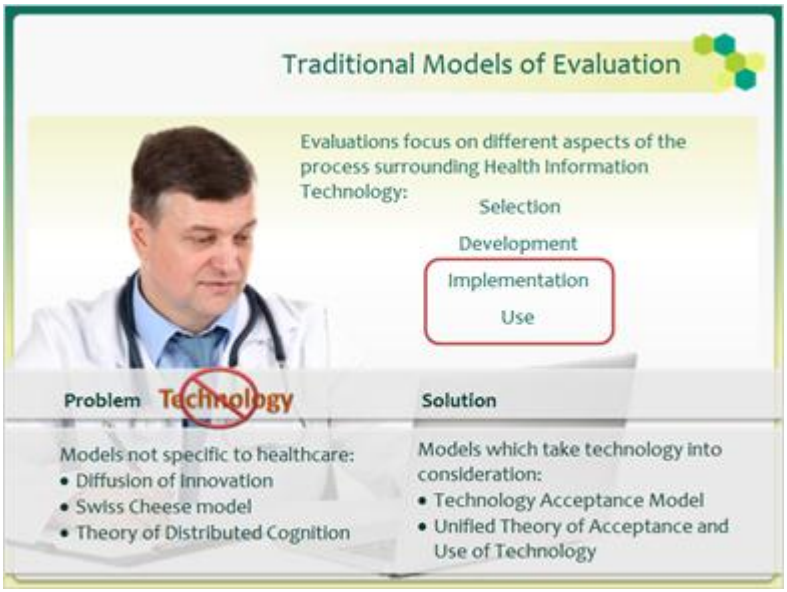
Example



Notes:

This example will illustrate the four elements. Let us begin with a nurse who enters in vitals for a patient including heart rate, respiration, temperature, and blood pressure; these are all pieces of data. When several sets of these vitals are organized, such as in an Electronic Health Record, and are longitudinally compared, this is considered information. From this comparison, the nurse may recognize that over time the blood pressure has dropped and the respirations have increased; a trend that is abnormal for the patient. The nurse may then determine that the patient is septic and needs intervention; this is considered knowledge. The nurse then decides on the intervention that is most appropriate for this patient; this is considered wisdom.

Traditional Models of Evaluation



Notes:

Several models exist to evaluate Health Information Technology.

Evaluations typically focus on different aspects of the process surrounding Health Information Technology, such as selection, development, implementation, and use. While nurses and nurse practitioners should be involved in the selection and development of Health Information Technology, they are more often asked to evaluate the impact and use of such systems. For this reason, this module will focus on those models that evaluate the implementation and use of these technologies.

Previous analysis and evaluation of Health Information Technology have utilized models not specific to healthcare. Models such as Roger's diffusion of innovation, Reason's Swiss Cheese model, and

Hutchin's theory of distributed cognition are examples of non-healthcare models applied to the healthcare setting. While these models do have generalizable elements that can be applied to health technology, they lack any technology specific elements.The ***Technology Acceptance Model*** and the ***Unified Theory of Acceptance and Use of Technology*** constructs were developed to address this issue.

Model References:

Rogers, E.M. (1995). Diffusion of Innovations.(4th Ed.) New York, New York: The Free Press.

Hutchins, E. (1995). Cognition in the wild. Boston, Massachusetts: MIT Press.

Reason J. (2000). Human error: models and management. British Medical Journal 320:768-70.

The TAM and UTAUT Model

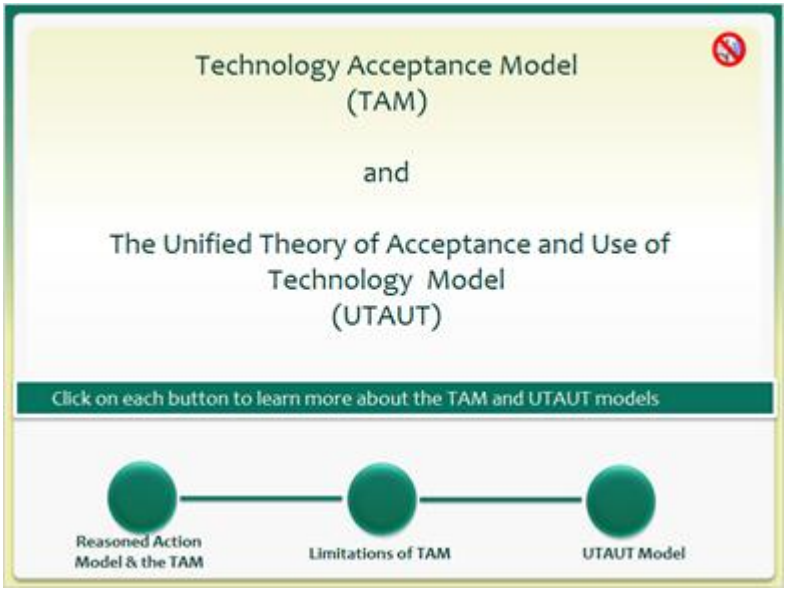


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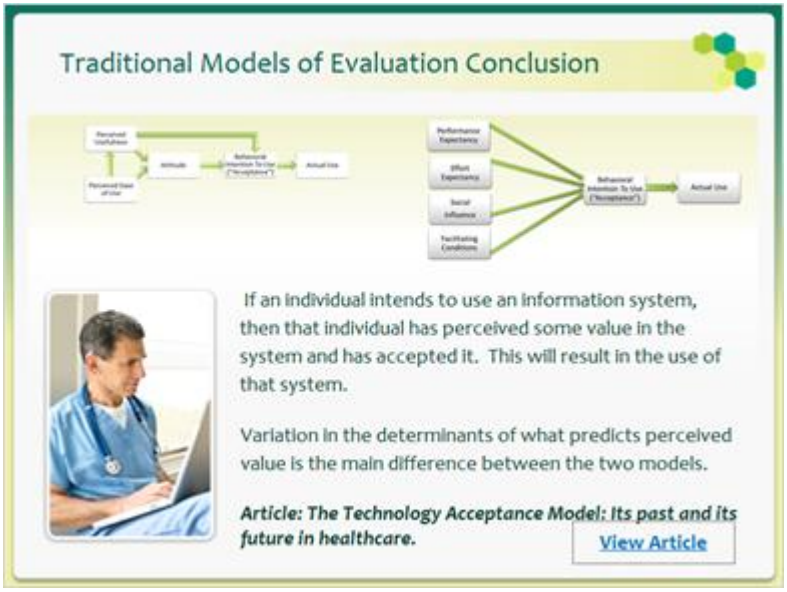
Image Reference:Holden, R. J., & Karsh, B. T. (2010). The technology acceptance model: its past and its future in health care. Journal of biomedical informatics, 43(1), 159-172.

Traditional Models of Evaluation Conclusion



Notes:

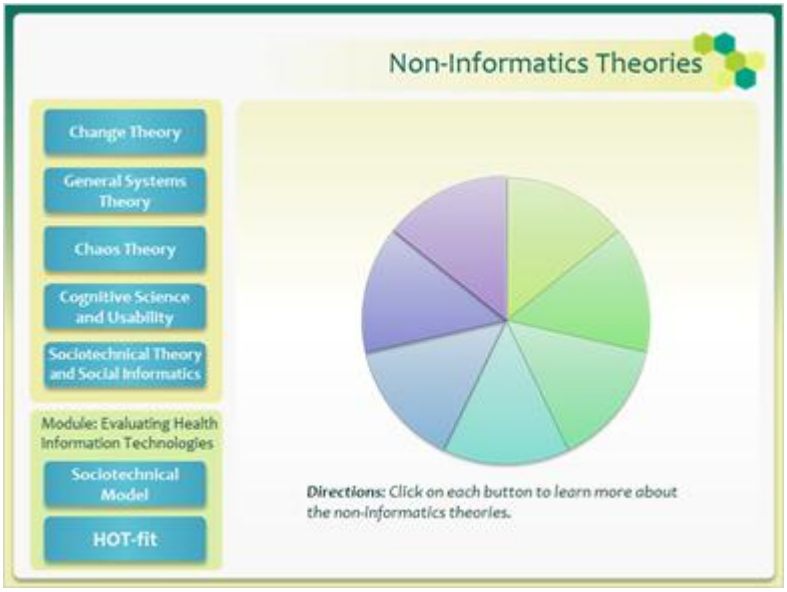
Both the TAM and the UTAUT models postulate, that if an individual intends to use an information system, then that individual has perceived some value in the system and has accepted it. This will result in the use of that system.

However, if an individual does not intend to use the system, then there has been no value placed on that system and it has not been accepted. Variation in the determinants of what predicts perceived value is the main difference between the two models.

For an in depth review of the use of the TAM in healthcare, read the article by Holden and Karsh - *The Technology Acceptance Model: Its past and its future in healthcare.*

Click on the "View Article" link to access the article.

Non-Informatics Theories



Notes:

You will now have the opportunity to review a few examples of Non-informatics theories. Select a theory to learn more about that theory.

CHANGE THEORY

Change theory, such as Rogers' Diffusion of Innovation Theory, categorizes individuals along an innovation adoption continuum from slow starters to innovators and explains how each type of individual along the continuum contributes to the success or failure of an innovation adoption. The understanding of the different types of individuals involved in the adoption of an innovation and their contributions to the process can inform an implementation plan by incorporating certain individuals at certain times. For example, an Electronic Health Record implementation plan may include the identification and use of early adopters to help promote and build buy in to the new system.

In addition, this theory can help promote and build "buy in" for the implementation of the new technology or health care system. For example, the transition from paper to electronic health records at the onset within an institution will have individuals represented across the adoption continuum. It is essential to engage all individuals appropriately to help them move along the adoption continuum so that the dissenters and slow starters do not jeopardize the success of the entire organizations implementation.

Image credit: http://en.wikipedia.org/wiki/Early_adopter

General Systems Theory

General systems theory can help inform informatists about the complexity of an information system from the point of view of a typical user. For example, a typical user might think that a change to an information system is a simple task but in reality the requested change is much more complex. In another scenario, a user might ask to have the ability to print from an Electronic Health Record. This may seem simple to the user however there are several steps to making this possible. These steps may include changes to:

- Security settings

- Printing settings
- Server settings
- Report settings

The whole is greater than the sum of its parts.

Chaos Theory

Chaos theory contributes to the field of informatics by helping us to better understand how the conditions at the starting point impacts the outcome, possibly in a non-linear fashion. For example, the preparation of faculty before the development of health informatics curriculum into a nursing program will impact not only the quality of the content, but the success of the learners.

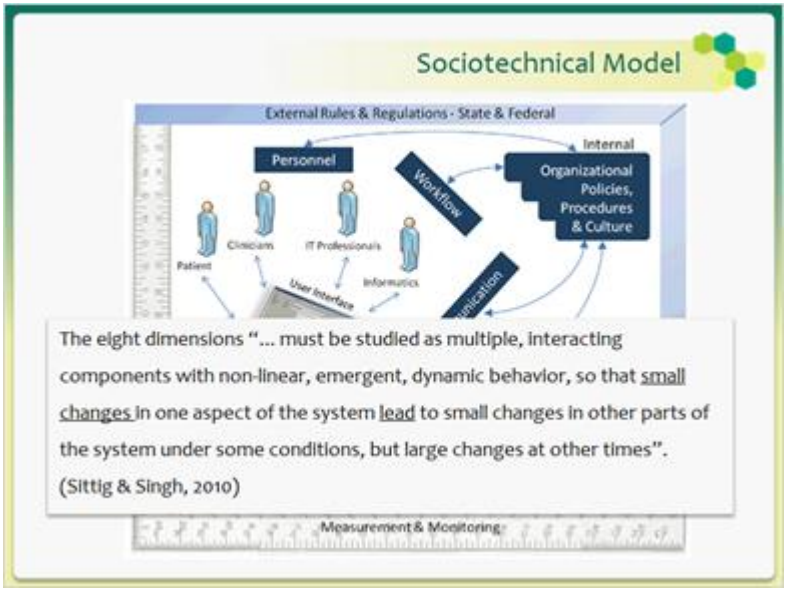
Sociotechnical Theory and Social Informatics

Sociotechnical theory and social informatics contribute by addressing how to improve the interaction between an information system and the organizational culture adopting the new innovation.

Cognitive Science and Usability

Cognitive science and usability contribute to informatics science by addressing the ability of an end user to gain and apply knowledge from an information system with the greatest ease of use and satisfaction.

Sociotechnical Model



Notes:

Sittig & Singh's **sociotechnical model** attempts to combine several different models to provide a single comprehensive evaluation model. The model aims to assess "the design, development, use, implementation and evaluation of Health Information Technology". The model is comprised of eight dimensions:

- Hardware and software
- Clinical content
- Human-computer interface
- People
- Workflow and communication
- Organizational policies and procedures
- External rules, regulations, and pressures AND,
- System measurements and monitoring

A major assumption of the model is the interaction between the eight dimensions. The eight dimensions should not be viewed as a series of independent sequential steps but as parts of an interactive system that influence one another. Sittig & Singh state that the eight dimensions "must be studied as multiple, interacting components with non-linear, emergent, dynamic behavior, so that small changes in one aspect of the system lead to small changes in other parts of the system under some conditions, but large changes at other times". For example, organizational leadership allocates the funding to purchase the hardware and software, and internal policies influence workflow and, potentially, the human-computer interface.

Evaluating the implementation and use of Health Information Technology through the lens of these eight interacting dimensions can identify factors to explain observed behavior and how those factors are influenced.

Image reference:

Sittig, D. F., & Singh, H. (2010). A new sociotechnical model for studying health information technology in complex adaptive healthcare systems. Quality and Safety in Health Care, 19(Suppl 3), i68-i74.

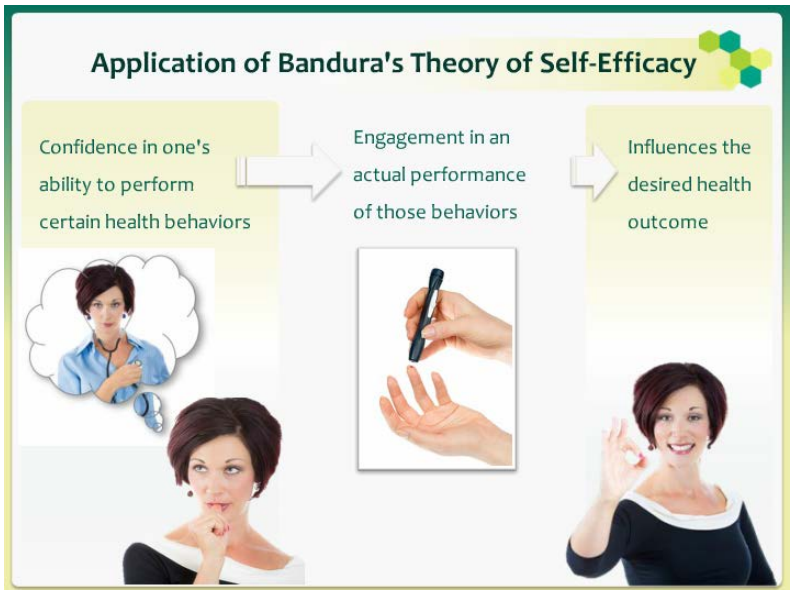
Human, Organization and Technology-fit factors (HOT-fit)

Notes:

Like the sociotechnical model, the **human, organization and technology fit factors or the HOT-fit model** attempts to integrate the interaction between technology, humans, and the organization. Derived from previous Health Information Technology evaluation models and two Information Systems evaluation models, the HOT-fit model is designed to help explain the use of technology in a given setting for a given population. The model can predict down to the level of the use of a particular piece of technology with a particular user in a particular setting. The model is comprised of eight dimensions broken down into four categories: technology, human, organization and net benefit. The fourth category is comprised of the eighth dimension alone - net benefit. Take a few moments to review the 8 dimensions and their categories shown here.

Influential and interactive relationships between the different categories and dimensions are illustrated. The HOT-fit model can predict both negative and positive adoption factors by evaluating the relationships between the dimensions and their influence on each other.

Example

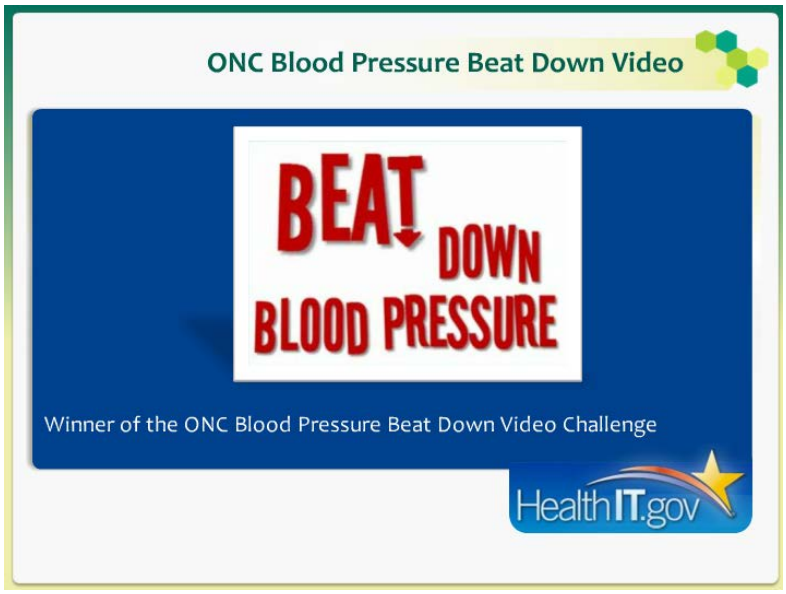


Notes:

An example of how a non-health informatics theory may be utilized to inform or explain the outcomes related to the development of new health informatics technology can be demonstrated when applying Bandura's theory of self-efficacy to a health care problem in which self-care behavior practices influence outcome. Bandura proposes that patients' confidence in their ability to perform certain health behaviors influences their engagement in an actual performance of those behaviors, which in turn influences the desired health outcome. An application that provides monitoring and positive re-enforcement for the completion of specific self-care behavior practices may improve the confidence of patients to continue practicing those behaviors and thus improve outcome.

Image Reference: https://wikispaces.psu.edu/display/PSYCH484/7.+Self-Efficacy+and+Social+Cognitive+Theories

Video: Ensuring the Security of Electronic Health Records



Notes:

At Health IT.Gov the winner of the ONC Blood Pressure Beat Down Video Challenge explains how he uses health IT to help with blood pressure monitoring.

This video demonstrates how the use of the app may improve the patients self-confidence to complete Blood pressure or BP monitoring daily and be more engaged in their BP health thus leading to overall lower BP.

http://www.healthit.gov/patients-families/video/blood-pressure-monitoring-regular-guy-beats-down-blood-pressure

Example

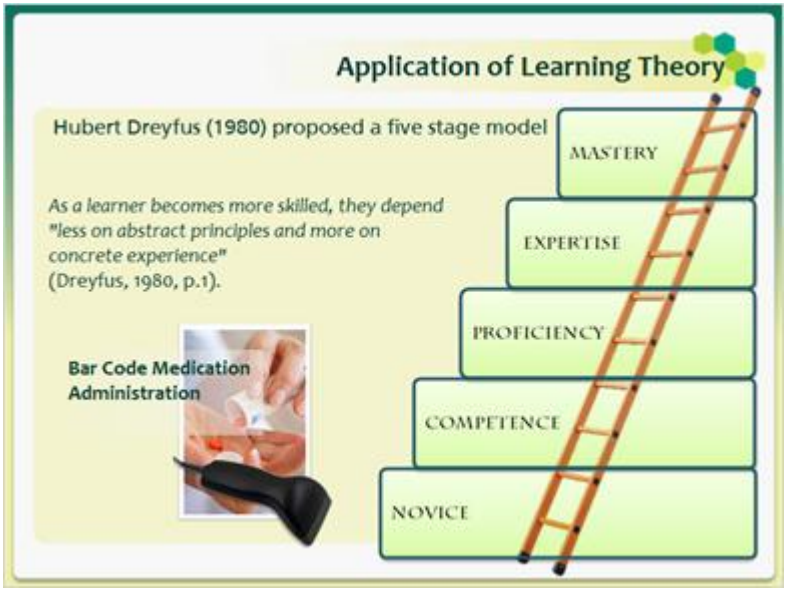
Notes:

To expand upon the previous example further, a mobile phone application may improve self-confidence and engagement in a person's ability to complete a particular self-care exercise. Consider the development of a mobile application which would facilitate the following:

- remind patients with hypertension to check their blood pressure daily,
- allows the patients to record that data or receive the data from a blood pressure device,
- send recorded data electronically to their physician and finally
- allow the physician to provide feedback.

Through an improvement in self-confidence and engagement, the mobile application may result in improving the management of a patient's hypertension.

Application of Learning Theory



Notes:

Hubert Dreyfus (1980) proposed a five stage model in which a skill is acquired by instruction and experience. In this model, a learner progresses along a developmental continuum from novice --> competence --> proficiency --> expertise --> mastery. To nurses, this model may seem familiar as it is a concept in which Patricia Benner expanded upon in the proposal of her nursing theory Novice to Expert (Benner, 1984).

The theory proposes that as a learner becomes more skilled, they depend "less on abstract principles and more on concrete experience" (p.1). The progression from novice to expertise is assisted by experience. A learner is able to replace abstract principles with concrete examples from their experiences. Let us consider how the Hubert Dreyfus model can be applied to teaching the skill of medication administration through the utilization of bar code medication administration. Click on each developmental level to see how students would move along the skill acquisition learning continuum.

Novice

At this level an introduction of the principles of safe medication administration is provided. The principles presented may include the 5 rights (right patient, right drug, right dose, right route, right time), interaction / incompatibility with other medications, pre-administration assessments.

An attempt to link the principles to the technology could also be provided at this level.

Competence:

At the competence level, students would be exposed to skills lab training. In such training the use of bar code medication administration is practiced in a simulated patient care setting. Students should be able to complete the mechanics of performing bar code medication administration.

Proficiency:

Students at this level would need rules, guides or principles to complete the task. Students would have supervised clinical practicums and a competency check off on the use of bar code medication administration could be performed. It is expected that students would be able perform bar code medication administration in the majority of situations with little assistance

Expertise:

At this level the student has performed bar code medication administration multiple times as an independent licensed nurse and has also experienced different bar code medication administration situations.

Mastery:

At the mastery level the student has performed bar code medication administration for an extended period of time. The student has experienced a variety of bar code medication administration situations and can perform the act of bar code medication administration with similar mental effort as that needed to driving a car.

Knowledge Check

Knowledge Check

(Drag and Drop, 10 points, 1 attempt permitted)

Feedback when correct:

That's right! You selected the correct response.

Feedback when incorrect:

Correct response:

Rogers Diffusion of Innovation theory :: A change model for guiding technological innovation

General Systems Theory :: Complexity of information systems

Nursing Informatics :: Data --> Wisdom continuum

Dreyfus Model of Skill Acquisition :: Development of expertise

Notes:

Melissa has been asked to identify theories which can be used to inform the integration of the new ICD-10 (International Classification of Diseases) code into an electronic health record. Melissa has been advised that the theories listed here can be utilized. Help Melissa to gain a better understanding of each theory by matching each theory to the most appropriate phrase or statement.

Drag each theory to the most appropriate phrase or statement on the left.

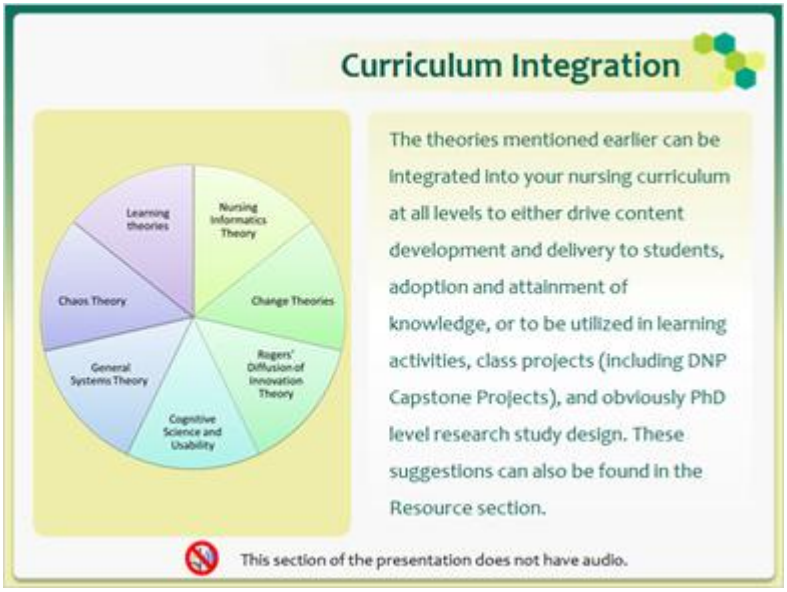
Summary

Notes:

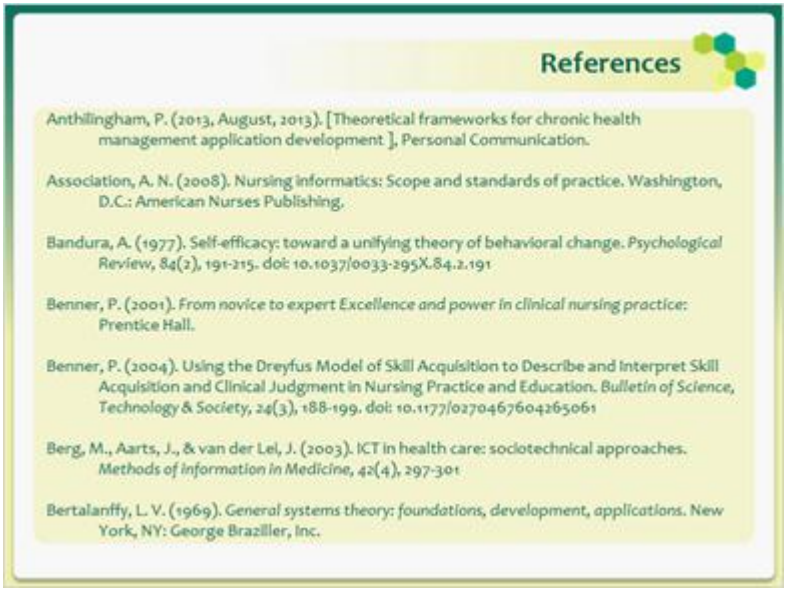
There are several theories that support the use of Nursing Informatics. In this module the following theories were reviewed: Nursing Informatics Theory, Change Theories, Rogers' Diffusion of Innovation Theory, Cognitive science and Usability, General Systems Theory, Chaos Theory, and learning theories.

Curriculum Integration

Curriculum Integration



References



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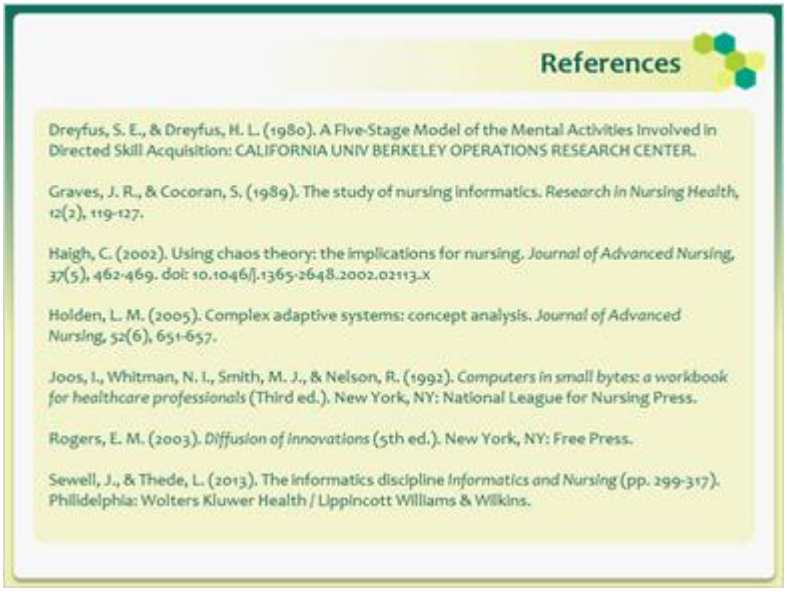

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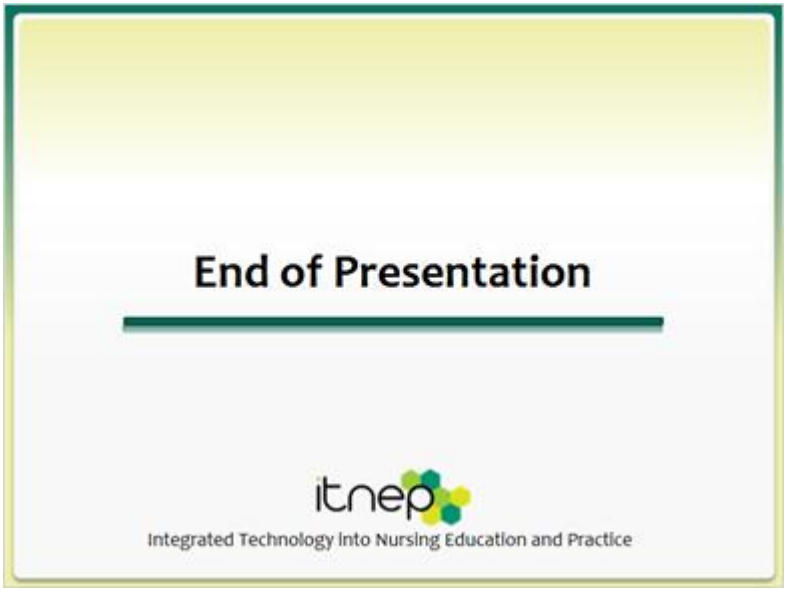
End of Presentation



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