

Unit 8: Virtual and Augmented Reality in Medicine

I. Pre-reading

A. New Vocabulary

Word / Term	Form	Definition / Synonym	Persian Translation
virtual reality	n	computer-generated simulation of real environments	واقعیت مجازی
augmented reality	n	overlaying digital information on the real world	واقعیت افزوده
simulation	n	imitation of a real process or system	شبیه‌سازی
visualization	n	process of forming images or models	تجسم / تصویرسازی
immersion	n	deep involvement in an artificial environment	غوطه‌وری / درگیری کامل
gesture	n	movement used as a control signal	ژست / حرکت دست
tracking	n	monitoring position or movement	ردیابی
projection	n	displaying images onto a surface	پروژکشن / نمایش تصویر
interactive	adj	allowing user participation or response	تعاملی
overlay	n	image displayed on top of another	لایه‌گذاری / اوورلی
navigation	n	controlling or guiding movement	ناوبری
remote assistance	n	helping someone through networked technology	کمک از راه دور

B. Pre-reading Questions

1. What is the difference between virtual and augmented reality?
2. How can VR help in medical training?
3. What are the clinical uses of AR in surgery?
4. What are the advantages of immersive visualization?

II. Reading

Virtual and Augmented Reality in Medicine

Virtual Reality (VR) and **Augmented Reality (AR)** are transforming modern medicine through immersive visualization and interactive learning. **VR** creates a completely digital environment that users experience through **headsets** and controllers, while **AR** overlays computer-generated images onto the real world.

In medical **education**, VR allows students to explore **3D anatomical models**, perform simulated surgeries, and practice procedures safely before operating on real patients. This **simulation-based learning** improves understanding, confidence, and motor skills.

In clinical **applications**, AR helps surgeons visualize organs and tissues in real time during operations. By projecting 3D anatomical overlays onto the patient's body, AR systems enhance **navigation**, **precision**, and reduce surgical errors. **Interactive interfaces** and **gesture control** allow hands-free manipulation of medical data during surgery.

VR and AR are also valuable in **therapy and rehabilitation**. Virtual environments motivate patients during physical or cognitive recovery, making therapy more engaging and effective. For example, stroke patients can practice limb movements in a VR game setting to accelerate progress.

Biomedical engineers develop VR/AR systems by integrating **tracking sensors**, **display technologies**, and **software algorithms** to achieve realistic and responsive experiences. Challenges include **cost**, **motion sickness**, and **data accuracy**, but continuous innovation promises wider use in training, diagnostics, and remote medical collaboration.

III. Post-reading

A. True (T), False (F), or Not Given (NG)

1. VR replaces the real world with a digital one.
 2. VR shows digital information on top of real-world views.
 3. AR can assist surgeons in navigation during operations.
 4. VR therapy helps patients recover motor function after stroke.
 5. VR and AR systems are widely used in current surgeries.
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B. Multiple Choice

1. What is the key difference between VR and AR?
 - a) VR uses real environments, AR uses imaginary ones.
 - b) VR immerses users in a virtual world, AR enhances the real one.
 - c) AR is more expensive than VR.
 - d) Both display the same images.
 2. Which field benefits most from VR-based simulations?
 - a) Construction
 - b) Medical training
 - c) Agriculture
 - d) Environmental studies
 3. AR systems in surgery improve:
 - a) Sleep monitoring
 - b) Tissue visualization and precision
 - c) Radiation exposure
 - d) Patient waiting times
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C. Fill in the blanks

1. Virtual Reality (VR) creates a completely _____ environment that replaces the real world.
2. Augmented Reality (AR) overlays computer-generated images onto the _____ world.
3. In medical education, VR allows students to perform _____ surgeries in a safe environment.
4. AR helps surgeons achieve greater _____ and reduce errors during operations.
5. AR systems project 3D anatomical _____ onto the patient's body in real time.
6. VR and AR make _____ and rehabilitation more engaging for patients.
7. Biomedical engineers integrate tracking _____, display technologies, and software algorithms for VR/AR systems.
8. Major challenges for widespread adoption include cost, motion _____, and data accuracy.