**Verification and Validation in Software Testing**

**Verification** evaluates software artifacts (such as requirements, design, code, etc.) to ensure they meet the specified requirements and standards. It ensures the software is built according to the needs and design specifications.

**Validation**evaluates software to meet the user’s needs and requirements. It ensures the software fits its intended purpose and meets the user’s expectations.

**Verification Testing**

* a set of software engineering standards, defined verification testing as “A test of a system to prove that it meets all its specified requirements at a particular stage of its development.
* **Code reviews, walkthroughs, inspections, design, and specification analysis** are common components of verification testing.
* Some important documents to be reviewed in this stage are **requirements specification, design blueprints, ER diagrams, database table design,**[**test cases**](https://www.browserstack.com/guide/writing-good-test-cases)**,**[**test scenarios**](https://www.browserstack.com/guide/how-to-create-test-scenarios)**,**[**traceability matrix**](https://www.browserstack.com/guide/importance-of-traceability-matrix-in-testing)**,** etc.
* Verification tests ensure that all development elements (**software, hardware, documentation, and human resources**) adhere to organizational and team-specific standards and protocols.
* It checks to authenticate that the **system design and architecture** are accurately engineered and error-free.
* Verification checks are often like studying the specifications and checking them against the code logic.

**Advantages**

By verifying at each stage, devs, product managers, and stakeholders can get more insight into what the product may need to be developed better in the coming stages.

**When to use**

* Verification tests must be run at every stage of development before any feature is implemented.
* For example, consider a button labeled “Add to Cart”. Before creating this button, verification tests would review all relevant requirements previously decided in the ideation and brainstorming phases.
* Let’s say the documentation says the button must be black with the lettering in white. It should be no larger than 10mm X 10mm, and it should constantly be visible in the top right corner of every website product page. Another button with the exact text, color, and dimensions should be placed under every product on the page.
* Before creating the button, design and requirements documents must be reviewed, and all necessary specifications must be listed before work begins.
* Before working on every feature or element on the page, this must be done so the devs do not miss any guidelines.

**Validation Testing**

* An activity that ensures that an end product stakeholder’s true needs and expectations are met.
* Unlike verification testing, which occurs at every stage in development, validation testing occurs at the end of a specific module or even after the software has been entirely built. Its primary intent is to ensure the final product matches the stakeholder and customer requirements.
* Most forms of QA fall under this category. All tests, from unit tests to User Acceptance Tests, are Validation tests. Some of the standard tests under this heading:
* Unit Testing
* Integration Testing
* Smoke Testing
* Functional Testing
* Performance Testing
* Regression Testing
* Security Testing
* System Testing
* Accessibility Testing
* Cross Browser Testing
* User Acceptance Testing

All validation tests ensure that a system works as planned by running all its functions and tracking tangible, quantifiable results.

**Advantages**

Any bugs missed during verification will be detected while running validation tests.

If specifications were incorrect and inadequate, validation tests would reveal their inefficacy. Teams will have to spend time and effort fixing them, but it will prevent a bad product from hitting the market.

**When to use**

Validation tests must be run after every feature or step in the development process is completed.

For example, unit tests, a form of validation tests, are run after every unit of code has been created.

[Integration tests](https://www.browserstack.com/guide/integration-testing) are run after multiple modules have been completed individually and are ready to be combined.

An essential element of validation testing is the running of [cross browser testing](https://www.browserstack.com/live). QAs must check that every function, feature, and design element appears and functions as expected on different browser-device-os combinations. For example, does the “Add to Cart” button work perfectly on Google Chrome running Samsung Galaxy A23 and Safari running on iPhone 13?