INSTRUCTURE

Penetration Test Results

Engineering, Security, and Operations

May 2020

In this guide, you'll learn:

How we partner with the third-party provider BugCrowd for ongoing penetration testing of our applications and services.

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Executive Summary

This is Instructure's 9th annual open security audit and once again Instructure engaged Bugcrowd, Inc. to perform an Ongoing Bounty Program, commonly known as a crowd-sourced penetration test for its Canvas LMS, Canvas Mastery, Bridge, Studio, Practice, and Portfolium products.

An Ongoing Bounty Program is a cutting-edge approach to an application assessment or penetration test. Traditional penetration tests use only one or two personnel to test an entire scope of work, while an Ongoing Bounty leverages a crowd of security researchers. This increases the probability of discovering esoteric issues that automated testing cannot find and that traditional vulnerability assessments may miss in the same testing period.

The purpose of this engagement was to identify security vulnerabilities in the targets listed in the targets and scope section. Once identified, each vulnerability was rated for technical impact defined in the findings summary section of the report.

This report shows testing for Canvas LMS, Canvas Mastery, Bridge, Studio, Practice, and Portfolium's targets during the period of: 01/01/2019 – 12/31/2019.

For this Ongoing Program, submissions were received from 60 unique researchers.

The continuation of this document summarizes the finding, analysis, and recommendations from the Ongoing Bounty Program performed by Bugcrowd for Canvas LMS, Canvas Mastery, Bridge, Studio, Practice, and Portfolium.

The full program brief can be found on Bugcrowd's website. If you are interested in joining our bug bounty program as a security researcher, please contact security@instructure.com with your Bugcrowd username and we will get you hooked up!

Keep learning,

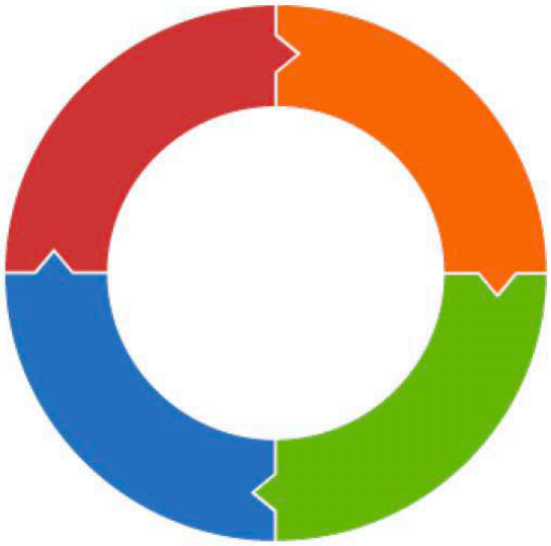
Josh Blackwelder,
Sr. Director and Head of Security
security@instructure.com

Reporting and Methodology

The strength of crowdsourced testing lies in multiple researchers, the pay-for-results model, and the varied methodologies that the researchers implement. To this end, researchers are encouraged to use their own individual methodologies on Bugcrowd ongoing programs.

01
Reconnaissance
Gathering information before the attack

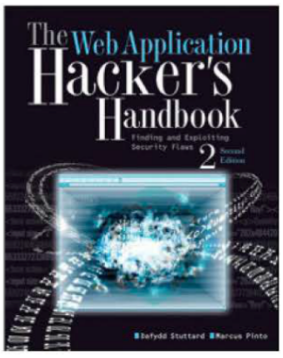
02
Enumeration
Finding attack vectors



04
Documentation
Collecting results

03
Exploitation
Verifying security weaknesses

Bugcrowd researchers who perform web application testing and vulnerability assessment usually subscribe to a variety of methodologies following the highlighted workflow, including the following:



NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Targets and Scope

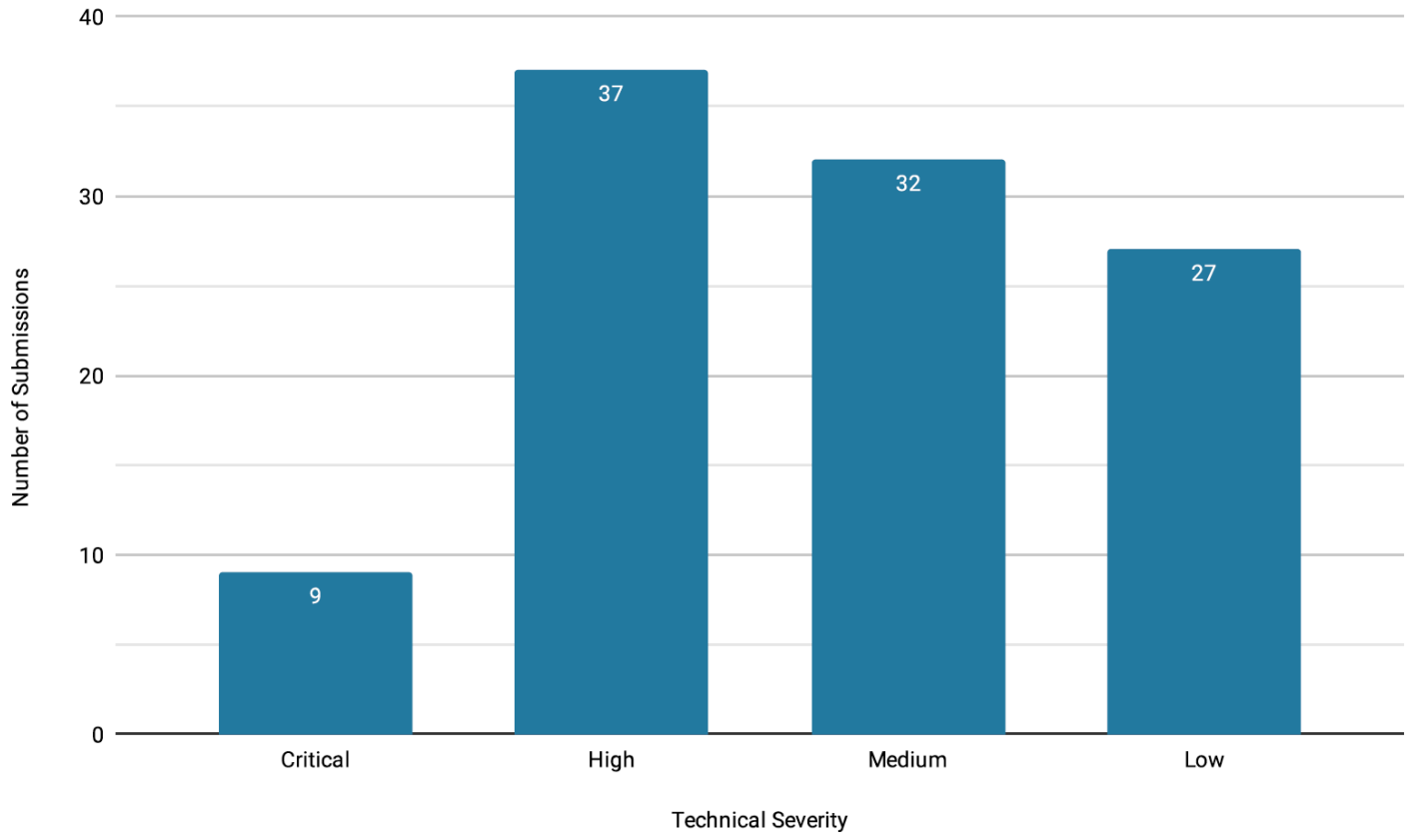
Prior to the Ongoing program launching, Bugcrowd worked with Instructure to define the Rules of Engagement, commonly known as the program brief, which includes the scope of work. The following targets were considered explicitly in scope for testing:

```
https://bugcrowd-tc.instructure.com
https://bugcrowd*.staging.bridgeapp.com
https://secttest.beta.instructuremedia.com
https://play.google.com/store/apps/details?id=com.instructure.candroid
https://play.google.com/store/apps/details?id=com.instructure.teacher
https://play.google.com/store/apps/details?id=com.instructure.parentapp
https://play.google.com/store/apps/details?id=com.instructure.androidpolling.app
https://itunes.apple.com/us/app/canvas-student/id480883488?mt=8
https://itunes.apple.com/us/app/canvas-parent/id1097996698?mt=8
https://itunes.apple.com/us/app/poll-for-canvas-create-take-polls-in-canvas-by-
instructure/id884329644?mt=8
https://*.stage.practice.xyz
https://app.stage.practice.xyz
https://*.suite.staging.bridgeapp.com
https://catalog-bugcrowd.inscloudgate.net
https://bugcrowd.suite.staginng.bridgeapp.com/connect
https://*qa.portfolium.com
https://commons-pdx-edge.inseng.net
```

Findings Summary

FINDINGS BY SEVERITY

The following chart shows all valid assessment findings from the program by technical severity.



RISK AND PRIORITY KEY

The following key is used to explain how Bugcrowd rates valid vulnerability submissions and their technical severity. As a trusted advisor Bugcrowd also provides common “next steps” for program owners per severity category.

Technical Severity	Example Vulnerability Types
Critical Critical severity submissions (also known as “P1” or “Priority 1”) are submissions that are escalated to Instructure as soon as they are validated. These issues warrant the highest security consideration and should be addressed immediately. Commonly, submissions marked as Critical can cause financial theft, unavailability of services, large-scale account compromise, etc.	• Remote Code Execution • Vertical Authentication Bypass • XML External Entities Injection • SQL Injection
High High severity submissions (also known as “P2” or “Priority 2”) are vulnerability submissions that should be slated for fix in the very near future. These issues still warrant prudent consideration but are often not availability or “breach level” submissions. “Commonly, submissions marked as High can cause account compromise (with user interaction), sensitive information leakage, etc.	• Lateral Authentication Bypass • Stored Cross-Site Scripting • Cross-Site Request Forgery for a critical function • Internal Server-Side Request Forgery
Medium Medium severity submissions (also known as “P3” or “Priority 3”) are vulnerability submissions that should be slated for fix in the major release cycle. These vulnerabilities can commonly impact single users but require user interaction to trigger or only disclose moderately sensitive information.	• Reflected Cross-Site Scripting with limited impact • Cross-Site Request Forgery for an important function • Insecure Direct Object Reference for a function
Low Low severity submissions (also known as “P4” or “Priority 4”) are vulnerability submissions that should be considered for fix within the next six months. These vulnerabilities represent the least danger to confidentiality, integrity, and availability.	• Cross-Site Scripting with limited impact • Cross-Site Request Forgery for an unimportant function • External Server-Side Request Forgery
Informational Informational submissions (also known as “P5” or “Priority 5”) are vulnerability submissions that are valid but out-of-scope or are “won’t fix” issues, such as best practices	• Lack of code obfuscation • Autocomplete enabled • Non-exploitable SSL issues

Bugcrowd's Vulnerability Rating Taxonomy

More detailed information regarding Bugcrowd's vulnerability classification can be found at: https://bugcrowd.com/vrt

FINDINGS TABLE

The following table lists all valid assessment findings from the program:

Title	VRT	Duplicates	Priority	State
Invalid Access Controls/Privilege Escalation – Teacher can gain School Administrator and change schools without approval of the target district. [MasteryConnect]	Broken Access Control (BAC)	-	P1	Resolved
SSRF to RCE [Portfolium]	Broken Access Control (BAC)	1	P1	Resolved
Public Google Calendar exposing Passwords, Conference call data, and critical PII info	Sensitive Data Exposure	3	P1	Resolved
Lead of Authorization Token via Bypass of Validation Functionality for External Tools [Canvas iOS]	Sensitive Data Exposure	-	P1	Resolved
Misconfigured CORS and CSRF to Steal user's all files [Portfolium]	Server Security Misconfiguration	2	P1	Resolved
ePortfolio export will bypass all access controls for files [Canvas]	Broken Access Control (BAC)	-	P1	Resolved
Unauthenticated RCE on /mstrit [MasteryConnect]	Server-Side Injection	-	P1	Resolved
Upload content to any Portfolium s3 bucket/ replace/delete website/user content [Portfolium]	Broken Authentication and Session Management	1	P1	Resolved
Leak of app Authorization token via Image with data-api endpoint [Canvas iOS]	Sensitive Data Exposure	-	P1	Resolved
Stored XSS [MasteryConnect]	Cross-Site Scripting (XSS)	-	P2	Resolved

Title	VRT	Duplicates	Priority	State
[Stored] XSS via exploit elementToggler.js [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS in Group Wiki Pages via Prerequisites lookup exploit [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS via `data-item-href` in Wiki Pages [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS via Exploiting jQuery Selector issue via `datafocus-returns-to` attribute [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
CSRF + BAC – Able to add email to any user account without authorization [Canvas]	Broken Access Control (BAC)	-	P2	Resolved
[Stored] XSS in KyleMenu (global widget) via kyleMenuOptions [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS in Arc via exploit of TrackFormatParser.dfxp.parse method [Studio]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS in ePortfolios via `data-popup-within` & `altrigger` class [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS via Bypass of sanitizeUrl functionality [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS via a.file_preview_link [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
Subdomain Takeover of *masteryconnect-staging.com subdomains [MasteryConnect]	Server Security Misconfiguration	-	P2	Resolved
Access to submission/comments media! [Canvas]	Broken Access Control (BAC)	-	P2	Resolved
XSS from student to anyone in ePortfolios [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS via Flash Message exploit [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved

Title	VRT	Duplicates	Priority	State
[Stored] XSS by editor_button.icon_url [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
Student can view course's unpublished/not allowed for students pages via atom feed [Canvas]	Broken Access Control (BAC)	-	P2	Resolved
CSRF on various endpoints (Following/Subscribing, Blocking, and Pin Liking) [MasteryConnect]	Cross-Site Request Forgery (CSRF)	-	P2	Resolved
[Stored] XSS via Malicious Lang Name inn CC [Studio]	Cross-Site Scripting (XSS)	-	P2	Resolved
CRLF injection leading to installation of a service worker on cdn.inst-fs-iad-prod.inscloudgate.net	Other	-	P2	Resolved
Student can access all unpublished/restricted course files! [Canvas]	Broken Access Control (BAC)	-	P2	Resolved
Stored XSS via math equation editor [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
Wormable Stored XSS! [Portfolium]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS via `data-turn-into-dialog` behavior [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
HTML5 AppCache can be used to intercept and modify file downloads on cdn.inst-fs-iad-prod.inscloudgate.net	Server Security Misconfiguration	-	P2	Resolved
CSRF [MasteryConnect]	Cross-Site Request Forgery (CSRF)	-	P2	Resolved
[Stored] XSS in Learner Submission via Video Response download link [Practice]	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS in Calendar via `data-mathml` attribute [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
Chat module see other people's chat, delete messages and impersonate users. [Canvas]	Broken Access Control (BAC)	-	P2	Resolved

Title	VRT	Duplicates	Priority	State
[Stored] XSS via Replacing Server Response for GET `media_objects/:media_object_id/info` [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
Subdomain takeover of *masteryconnect.com subdomains [MasteryConnect]	Server Security Misconfiguration	-	P2	Resolved
[Stored] XSS in ePortfolios [Canvas]	Cross-Site Scripting (XSS)	-	P2	Resolved
Subdomain takeover via unclaimed Heroku Instance bridge registration. bridgeapp.com [Bridge]	Server Security Misconfiguration	-	P2	Resolved
Multiple XSS on /app/:id [eduappcenter.com]	Cross-Site Scripting (XSS)	-	P2	Resolved
Insufficient Access Controls [eduappcenter.com]	Broken Access Control (BAC)	-	P2	Resolved
[Stored] XSS via `data-tooltip` HTML exploit	Cross-Site Scripting (XSS)	-	P2	Resolved
[Stored] XSS in Media Comments via Subtitles (similar to Arc issue) [Studio]	Cross-Site Scripting (XSS)	-	P2	Resolved
Insecure access control handling on what-if requests for muted Quizzes allows for hidden scores to be read	Broken Access Control (BAC)	-	P3	Resolved
Subdomain takeover via unclaimed acquia.com domain for ondeckdev.blog.instructure.com	Server Security Misconfiguration	-	P3	Resolved
Stealing private information with XSS – Reflected XSS – Bypass WAF	Cross-Site Scripting (XSS)	2	P3	Resolved
Social media account compromise via instructure.com/about/blog	Server Security Misconfiguration	-	P3	Resolved
Access to Kibana instance	Broken Authentication and Session Management	-	P3	Resolved

Title	VRT	Duplicates	Priority	State
DOM XSS in both “t” and “s” parameter at recordedwebinar. html page [masteryconnect-staging.com]	Cross-Site Scripting (XSS)	-	P3	Resolved
Access to internal excel document, leaking finance data and vendor sheet and cost agreements, etc.	Sensitive Data Exposure	-	P3	Resolved
[Stored] XSS in vdd_tooltip_link (exploit jQuery selector)	Cross-Site Scripting (XSS)	-	P3	Resolved
[Stored] CSS in Canvas Quizzes via malicious response from server	Cross-Site Scripting (XSS)	-	P3	Resolved
[Stored] XSS in Courses (by combining two issues)	Cross-Site Scripting (XSS)	-	P3	Resolved
Student can access files with restricted access with link	Broken Access Control (BAC)	-	P3	Resolved
Blind SSRF due to misconfiguration	Broken Access Control (BAC)	-	P3	Resolved
Stored XSS via SVG file on Portfolium	Broken Access Control (BAC)	4	P3	Resolved
[masteryconnect-staging.com] CVE-2018-6389 – Application-level DoS in loading scripts function	Application-level Denial-of-Service (DoS)	-	P3	Resolved
Unauthenticated user can see events and locations of public courses	Broken Access Control (BAC)	-	P3	Resolved
Stored XSS via iframe	Cross-Site Scripting (XSS)	1	P3	Resolved
Stored XSS via rubric in SpeedGrader option	Cross-Site Scripting (XSS)	1	P3	Resolved
Users can see automatically graded scores on muted or hidden assignments	Server Security Misconfiguration	1	P3	Resolved

Title	VRT	Duplicates	Priority	State
Application-level DoS due to video title lack of content length limit	Application-level Denial-of-Service (DoS)	-	P3	Resolved
IDOR – Access other account user's PII information (email, role, full name, job, hire_date) [Bridge]	Broken Access Control (BAC)	-	P3	Resolved
Stored XSS on Upload Gradebook	Cross-Site Scripting (XSS)	1	P3	Resolved
Application-level DoS on project comment_list due to lists are not sanitized	Application-level Denial-of-Service (DoS)	-	P3	Resolved
No rate limit leads to send thousands of email to hundreds of users at once	Server Security Misconfiguration	-	P3	Resolved
Enumeration of names of users	Server Security Misconfiguration	-	P3	Resolved
SSRF in add app by URL function	Broken Access Control (BAC)	-	P3	Resolved
Stored XSS in Markdown link feature at project's description can be use against anyone (even non-Portfolium users) – bypass WAF	Cross-Site Scripting (XSS)	-	P3	Resolved
BAC – Able to attach my project to any other user's courses (and other items)	Broken Access Control (BAC)	-	P3	Resolved
IDOR – Create/Delete question bank and questions in other accounts	Broken Access Control (BAC)	-	P3	Resolved
IDOR – A user is possible to read all to-do info of other account users with same ID – information leakage	Broken Access Control (BAC)	1	P3	Resolved
Exif data not stripped [MasteryConnect]	Sensitive Data Exposure	-	P3	Resolved
Reflected CSS via successFlash parameter	Cross-Site Scripting (XSS)	-	P3	Resolved

Title	VRT	Duplicates	Priority	State
Stored XSS	Cross-Site Scripting (XSS)	-	P3	Resolved
Open Redirect	Unvalidated Redirects and Forwards	-	P4	Resolved
IDOR Delete planner_notes of another user	Broken Access Control (BAC)	-	P4	Resolved
Unvalidated redirect at login page [return_url param]	Unvalidated Redirects and Forwards	-	P4	Resolved
Click-jacking to deactivate admin account via user's account	Server Security Misconfiguration	-	P4	Resolved
Course members without permission to view grades can see grades via the Student Interaction Report	Broken Authentication and Session Management	-	P4	Resolved
Course members without permission to view or manage grades can download all quiz submissions	Broken Authentication and Session Management	-	P4	Resolved
Unauthenticated users can send arbitrary HTTP requests to remote hosts	Broken Access Control (BAC)	1	P4	Unresolved
Open redirect – "location" param at [/sso/authmonger/login]	Unvalidated Redirects and Forwards	-	P4	Resolved
GET-based open redirection	Unvalidated Redirects and Forwards	1	P4	Unresolved
SSRF on "change picture"	Broken Access Control (BAC)	-	P4	Resolved
Unvalidated GET-based redirect on oath.staging.bridgeapp.com	Unvalidated Redirects and Forwards	-	P4	Resolved
No rate limiting on email triggering function of "forgot password" feature	Server Security Misconfiguration	-	P4	Resolved

Title	VRT	Duplicates	Priority	State
Lack of rate limiting in promotion code for paid courses [Catalog]	Server Security Misconfiguration	-	P4	Resolved
Internal data exposure	Server Security Misconfiguration	-	P4	Resolved
Failure to invalidate session on password change	Broken Authentication and Session Management	-	P4	Unresolved
Enumeration of course names	Other	-	P4	Resolved
Course members without permission to see submissions can receive email notifications with submission information	Broken Access Control (BAC)	-	P4	Resolved
No rate limit on login form	Server Security Misconfiguration	3	P4	Resolved
Open redirect in course assignment	Unvalidated Redirects and Forwards	-	P4	Resolved
Broken access control on private comment portfolio	Broken Access Control (BAC)	-	P4	Resolved
IDOR edit group sets of other user's courses	Broken Access Control (BAC)	-	P4	Resolved
Course members without permission to view or manage grades can view complete submitted quizzes	Broken Authentication and Session Management	-	P4	Resolved
Unvalidated redirect in any URL path [blog.masteryconnectstaging. com]	Unvalidated Redirects and Forwards	-	P4	Resolved
Publicly exposed production statuses of all hosts – prod / staging / beta of instructure.com and bridgeapp.com	Server Security Misconfiguration	-	P4	Resolved
Course members without permission to see submissions can receive email notifications with submission comments	Broken Access Control (BAC)	-	P4	Resolved

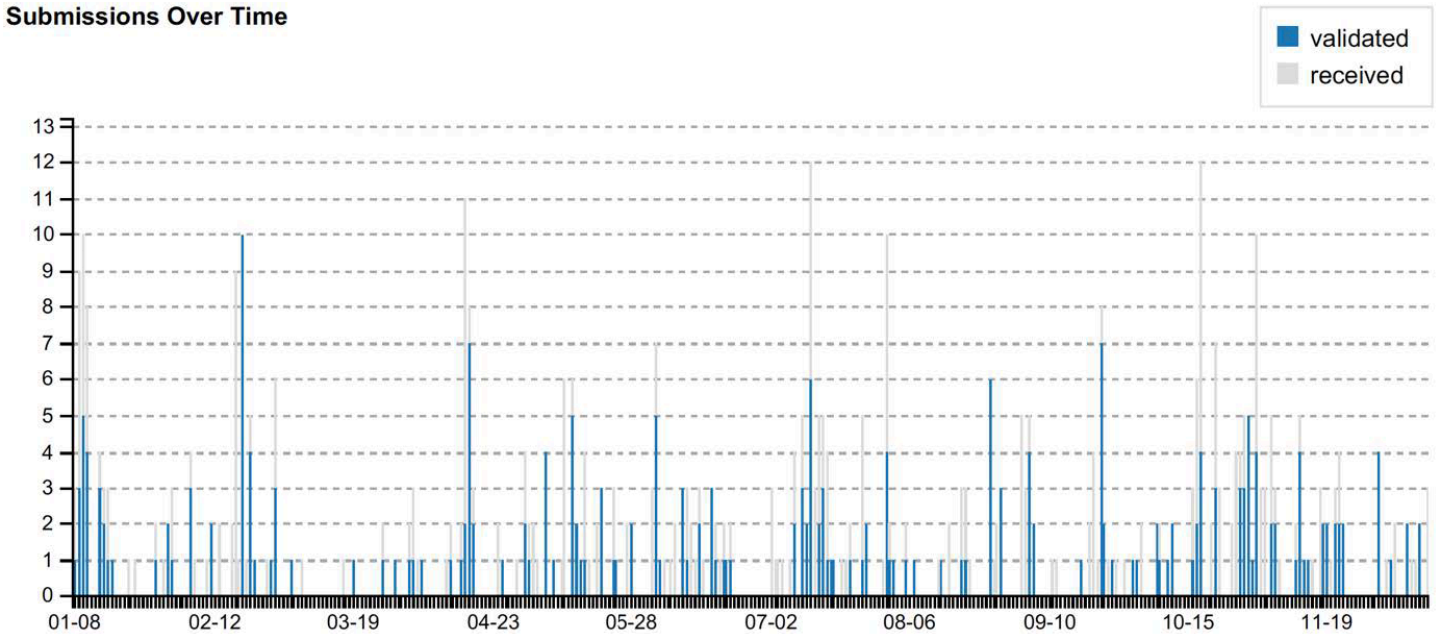
Title	VRT	Duplicates	Priority	State
Unvalidated redirect in OAuth endpoint [state parameter]	Unvalidated Redirects and Forwards	-	P4	Resolved
Other active sessions are not invalidated after a user completes the password reset process	Broken Authentication and Session Management	-	P4	Resolved

Appendix

Included in this appendix are auxiliary metrics and insights into the Ongoing program. This includes information regarding submissions over time, payouts, and prevalent issue types.

SUBMISSIONS OVER TIME

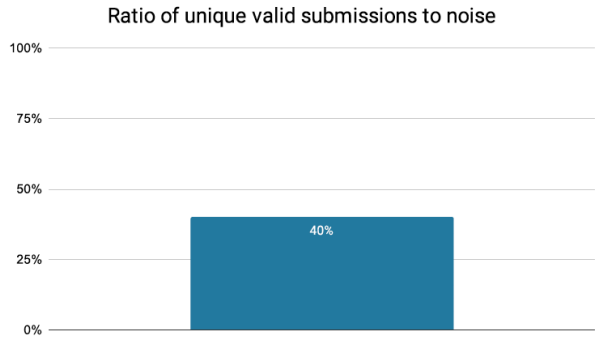
The timeline below shows submissions received and validated by the Bugcrowd team:



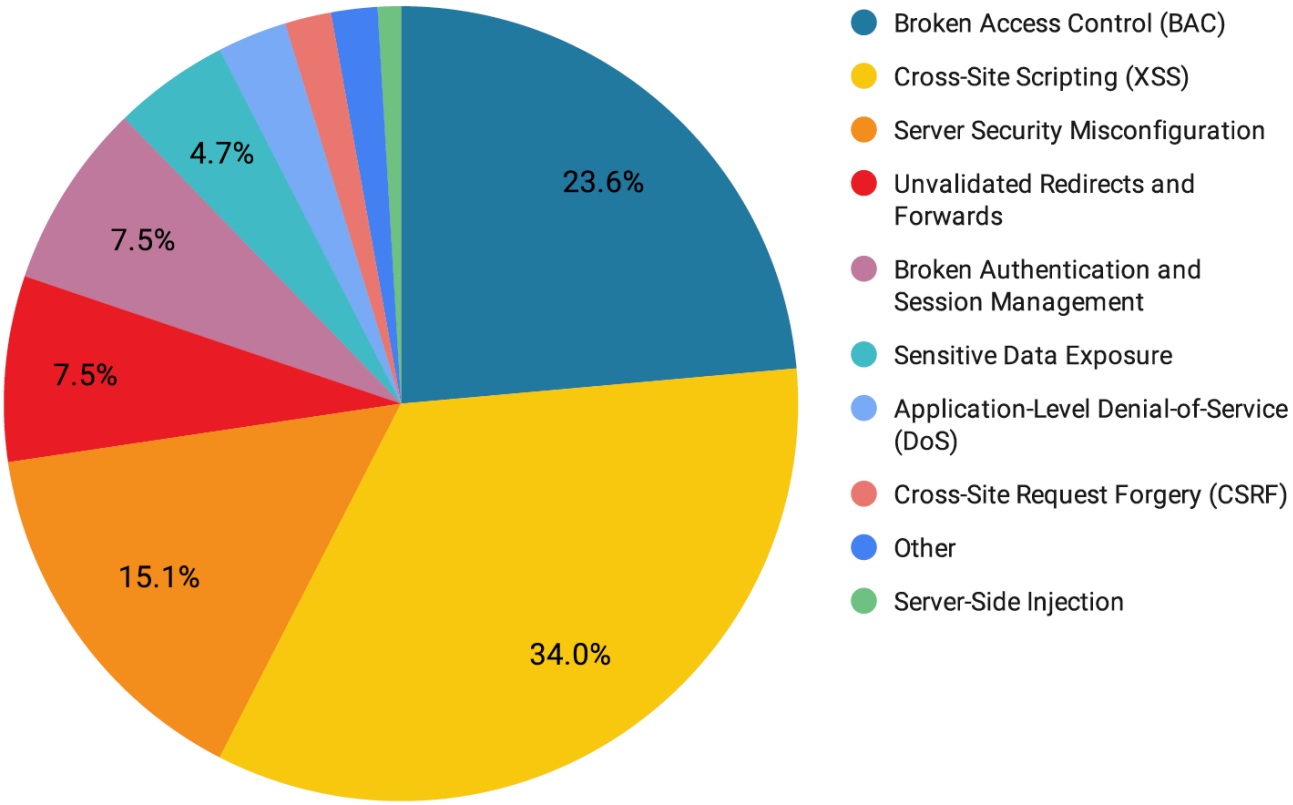
SUBMISSIONS SIGNAL

A total of **265** submissions were received, with **105** unique, valid issues discovered. Bugcrowd identified **54** duplicate submissions, removed **106** invalid submissions, and is processing **0** submissions. The ratio of unique, valid submissions to noise was **40%**.

Submission Outcome	Count
Valid	105
Invalid	106
Duplicate	54
Processing	0
Total	**265**



BUG TYPES OVERVIEW



Closing Statement

Bugcrowd Inc.

921 Front St.

Suite 100

San Francisco, CA 94111

INTRODUCTION

This report shows testing of Canvas LMS, Bridge, Studio, Practice, Portfolium, and Canvas Mastery between the dates of 01/01/2019 – 12/31/2019. During this time, 60 researchers from Bugcrowd submitted a total of 265 vulnerability submissions against Instructure's targets. The purpose of this assessment was to identify security issues that could adversely affect the integrity of Instructure's products. Testing focused on the following:

```
https://bugcrowd-tc.instructure.com
https://bugcrowd*.staging.bridgeapp.com
https://secttest.beta.instructuremedia.com
https://play.google.com/store/apps/details?id=com.instructure.candroid
https://play.google.com/store/apps/details?id=com.instructure.teacher
https://play.google.com/store/apps/details?id=com.instructure.parentapp
https://play.google.com/store/apps/details?id=com.instructure.androidpolling.app
https://itunes.apple.com/us/app/canvas-student/id480883488?mt=8
https://itunes.apple.com/us/app/canvas-parent/id1097996698?mt=8
https://itunes.apple.com/us/app/poll-for-canvas-create-take-polls-in-canvas-by-
instructure/id884329644?mt=8
https://*.stage.practice.xyz
https://app.stage.practice.xyz
https://*.suite.staging.bridgeapp.com
https://catalog-bugcrowd.inscloudgate.net
https://bugcrowd.suite.staginng.bridgeapp.com/connect
https://*qa.portfolium.com
https://commons-pdx-edge.inseng.net
```

The assessment was performed under the guidelines provided in the statement of work between Instructure and Bugcrowd. This letter provides a high-level overview of the testing performed, and the results of that testing.

ONGOING PROGRAM OVERVIEW

An Ongoing Program is a novel approach to a penetration test. Traditional penetration tests use only one or two researchers to test an entire scope of work, while an Ongoing Program leverages a crowd of security researchers. This increases the probability of discovering esoteric issues that automated testing cannot find and that traditional vulnerability assessments may miss, in the same testing period.

It is important to note that this document represents a point-in-time evaluation of security posture. Security threats and attacker techniques evolve rapidly, and the results of this assessment are not intended to represent an endorsement of the adequacy of current security measures against future threats. This document contains information in summary form and is therefore intended for general guidance only; it is not intended as a substitute for detailed research or the exercise of professional judgment. The information presented here should not be construed as professional advice or service.

TESTING METHODS

This security assessment leveraged researchers that used a combination of proprietary, public, automated, and manual test techniques throughout the assessment. Commonly tested vulnerabilities include code injection, cross-site request forgery, cross-site scripting, insecure storage of sensitive data, authorization/authentication vulnerabilities, business logic vulnerabilities, and more.

SUMMARY OF FINDINGS

During the engagement, Bugcrowd discovered the following:

Count	Technical Severity
9	**Critical** vulnerabilities
37	**High** vulnerabilities
32	**Medium** vulnerabilities
27	**Low** vulnerabilities
0	**Informational** findings